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APPLIED ANTHROPOLOGY AND THE AMERICAN ANTHROPOLOGISTS[1]

By Dr. MELVILLE J. HERSKOVITS
NORTHWESTERN UNIVERSITY

THE anthropologist, in following the dictum that the proper study of mankind is man, must inevitably answer the questions that arise from the related fact that, in the last analysis, mankind's greatest curiosity is also man. And to-day, when this natural curiosity is reinforced by the pragmatic philosophy of our time, it has become increasingly difficult for students of humankind to maintain the detachment of the scientist who works with non-human materials.

Faced with the brilliant examples of the successful application of results of research in the fields of the physical, natural and medical sciences, there are those who emphasize the desirability and the urgency of producing like results in the study of man. What, in the final analysis, they ask, validates the ends of science, and the support given the scientist by society, if it is not to point the way to immediate gains accruing from the work thus supported? How justify his withdrawal to the ivory tower, where, occupied with his researches, the worker seemingly ignores all those facets of his work that impinge on the practical problems of contemporary life? The issues raised by these questions are not lacking in importance. For in considering them, not only are we concerned with the problem of the aims of pure science and the obligation of the scientist to society, but also with the never-ending problems of the relationship between the scientist and the engineer, the thinker and the doer, the planner and the executive. And it is some of the implications of

[1] Address of the vice-president and chairman of the Section of Anthropology, American Association for the Advancement of Science, St. Louis, January 3, 1936.

these questions, as they bear upon the field of anthropology and the work of American anthropologists, that it is proposed to examine at this time.

Recent use of the term "applied anthropology" has defined the studies of cultural life of primitive folk rather than those branches of the discipline having to do with physical type or with prehistory or linguistics. The practical applications of physical anthropology were illuminatingly and carefully set forth last year in the address of my predecessor in this office,[2] when the importance of recent techniques and discoveries in the fields of growth and development of children was demonstrated for those concerned with the practical problems of child care. In the field of race differences or the classification of racial types, however, there are few who would not hesitate to set down positive programs of action on the basis of present-day knowledge. Indeed, such contributions as they make to practical affairs of race are in the nature of the case principally negative. Theirs is the word of caution in drawing conclusions about race, and the refutation of "principles" of race advanced by those not sufficiently versed in the subject. In the main, then, it can be said that the shield of the traditions of the natural sciences makes it possible for the physical anthropologist to work in the seclusion of the laboratory and emerge only to administer a rebuke to those who would go too fast in drawing conclusions not as yet justified by the progress of the work.

Any analysis of what has come to be known as "applied anthropology," therefore, primarily involves applications of our ethnological knowledge, though the phrase "applied anthropology" itself has a twofold meaning. Chiefly, it describes those applications of anthropology that can be made and are made to the problems of administration and education confronting government officials, and others, who must deal with the primitive folk under their charge. A recent discussion of the relationship between anthropology and the administration of native peoples in New Guinea provides a useful definition of this type of applied anthropology:

> Anthropology, it is now agreed, must concern itself with the broad problem of the reconciliation of natives to the changes which must inevitably take place as a result of European contact. It must plan to help the people bridge the gulf between their primitive culture and the requirements of modern days; to ensure their social stability, economic welfare, and future progress. This is the task *par excellence* of anthropology as an applied science.[3]

The other meaning of the term involves those applications of anthropological knowledge that can be made, and are made but too infrequently, to problems of our own culture—a usage more in accord with the underlying intellectual assumptions implicit in the subject held by many anthropologists, and preponderantly by those in this country. A brief statement of the aims of this kind of application of anthropological knowledge is to be had in the following:

> . . . Some of the most firmly rooted opinions of our times appear from a wider point of view as prejudices, [but] a knowledge of anthropology enables us to look with greater freedom at the problems confronting our civilization. . . . A clear understanding of the principles of anthropology illuminates the social processes of our own times and may show us, if we are ready to listen to its teachings, what to do and what to avoid.[4]

It might well be argued that ideally there need be no cleavage between the two approaches. Yet the stress of the application of anthropology to the practical problems of the administration of primitive peoples that has such currency at the present time is a pragmatic problem in the extreme, and the anthropologist must be realist enough to see it as such. This pragmatic emphasis comes, logically enough, from those European countries which have great colonial empires, comprising populations of primitive folk the disregard of whose traditions brings on irritation, unrest and, if carried too far, demoralization. In this country, also, the new policies of the Indian Bureau give point and urgency to the question of the relationship that should obtain between a governmental agency attempting to put into effect a policy toward the Indians based on an understanding of Indian cultures, and the obligations of the anthropologists and potential rôle to be played by them in the situation.[5]

Yet even in this latter sense, more than one meaning is given the phrase "applied anthropology." On the one hand, there is the type of applied anthropology in which anthropological training is required for admission to the Colonial service. In this type, which may be spoken of as *indirect* application of anthropological knowledge, the anthropologist teaches those concerned with primitive folk the principles and facts of his subject, with perhaps some special reference to their particular problems. In the other, which may be called *direct* application of anthropology, the anthropologist himself goes into the field to study those aspects of primitive life which he is requested to study by an

[2] T. Wingate Todd, SCIENCE, 81: 2098, pp. 259–263, March 15, 1935.

[3] William C. Groves, *Oceania*, 6: 94, 1935.

[4] F. Boas, "Anthropology and Modern Life" (revised edition, pp. 3 and 11).

[5] Applied anthropology has afforded the subject-matter for the addresses of the president of the Royal Anthropological Institute, Professor J. L. Myres, in 1929 and 1931, and of the chairman of the Section of Anthropology of the Australian and New Zealand Association for the Advancement of Science, Professor A. R. Radcliffe-Brown, at the Brisbane meetings of 1930. A section of Professor Brown's address as chairman of Section H of the British Association in 1931 was likewise devoted to the same topic.

administrator, answering specific problems put before him by a colonial official who may or may not use the data in formulating his policy toward native life. And just as the application of anthropology to the government of primitive peoples has been much more prominently discussed in recent years than its application to the understanding of our own problems, so, within the former category, the employment of anthropologists as aides and advisers to administrators has been much more to the fore than has been the question of the teaching of anthropology to officials. Because of this emphasis, we shall here principally touch upon this type of applied anthropology in making the assessment that is necessary if we are to see the problems that confront the American anthropologists.

Though the academic tradition holds that a devotion to knowledge is a valid enough end in itself, yet the drive to solve the pressing problems of humanity concerns the anthropologist as a citizen no less than it does his fellows. What form shall this concern take? Shall he hold to the long-term view or shall he accede to the demand that his work show immediate results? The case for the latter view has been clearly and succinctly put by Professor Malinowski:

> The slogan of complete academic independence is all very well, especially if it were the case of submitting science and teaching to political influences, but that the whole vast branch of study which ambitiously calls itself the Science of Man ought to remain completely aloof from the real troubles and difficulties which beset the management of one race by another, and their contacts and cooperations, this is surely an anomalous and unhealthy state of affairs.[6]

In this quotation, another important point is implied, for the obligation of the anthropologist is a dual one, arising out of the manner in which he must gather his data. Though as any other scientist, he must repay his debt to his own society, he also can not forget what he owes to the primitive peoples who give him the information without which his discipline could not exist. And in this, his situation is unique. The subject-matter of the ethnologist is the human being; to obtain his data he must make friends of the primitives he studies, and only to the extent that he does gain their confidence will his research be of value. Yet often he belongs to a political entity which has taken away the right of self-direction from the very people he is studying. He is a member of a group, whether he be European or American, whose superior technological achievements have enabled it to impose upon the primitive peoples under its control duties and obligations foreign to them; to insist that they take over moral, social and legal systems strange to their traditions; and to put upon them economic burdens under which they not only become restive, but to carry which their institutions must often be so drastically reorganized that a destruction of the patterns of living essential for an adjusted life is entailed. We must ask, therefore, to what extent an exact knowledge of the patterns of native life will actually permit the administrator to ease, in any fundamental sense, the burden on the natives he rules? May it not also aid him in fastening this burden more tightly upon them, if policy dictates such a course?

It would be unjust to claim that anthropologists who are concerned with the application of anthropology to the administration of primitive folk are actuated by any but the greatest sympathy with the natives. Nor is it to be denied that, faced with a situation in which the contact of native and European cultures is operating not only to demoralize the primitive folk, but in some cases to obliterate them, there is much reason for approaching the problem with the greatest political realism; for undertaking, whatever the cost, to cushion the clash of cultures to any degree possible, even though this may seem in some measure to further the interests of those who are responsible for the harm. This attitude has been well expressed in Professor Radcliffe-Brown's presidential address before the Australian and New Zealand Association:

> What one would like to see in such a region as the Mandated Territory would be a body of research workers engaged in the systematic study of the native social organization handing on their knowledge to an administration that would be able to decide on policies to be adopted. The effects of any policy could then be scientifically observed under control, and something approaching the laboratory methods of other sciences could be reached. A real experimental anthropology would be the result. If it is to be objected that we ought not to experiment in this way with human beings, the reply is that we are already experimenting, but the experiments are not scientifically conducted but are blind, made without any real knowledge of what the results are likely to be. While our present efforts often bring, instead of benefit, disaster to the people whom we govern, in the form of social disintegration or depopulation, a more scientifically controlled experimental policy would stand a much better chance of avoiding harm and giving them at least some benefits. One can feel quite certain that more knowledge of the nature of Indian culture and a proper grasp of the laws of social integration would have prevented our long experiment with India from reaching its present unsatisfactory position.[7]

Therefore, in analyzing the recent developments in the field of applied anthropology, it must be carefully remembered that the point at issue is an evaluation of wisdom of procedure, and of the amount of help that can be given the native by the anthropologist in apply-

[6] *Africa*, 3: 428, 1930.

[7] *Op. cit.*, pp. 12–13 (of reprint).

ing his knowledge to the problems in the ruling of primitive folk, rather than any assessment of underlying motivation.

The widest use of applied anthropology among colonizing powers has been in England and the Netherlands. In the case of the latter, and in much of the application of anthropological knowledge found in the former, this takes the indirect form of teaching those who are contemplating entering the colonial service;[8] or, from the point of view of the administration, of making anthropological training requisite to appointment. It is not necessary here to trace the development of a sentiment, both among anthropologists and colonial officials, in favor of such training, for the addresses of Professor Myres, especially that of 1929, have done this in great detail,[9] as has the discussion of Professor Seligman in the most recent edition of the Encyclopaedia Britannica.[10] Both these, however, emphasize the indirect application of anthropology to the problems of governing native folk. Indeed, even where the direct approach is mentioned, it goes no further than recommendations for the appointment of government anthropologists; as where Professor Seligman, commenting on the fact that

> All governments have their experts in geology, botany, agriculture and zoology in its many branches; it is a strange paradox that so often man alone should be unstudied. . .

recommends

> In order to save the backward races from extinction and enable them to adapt to new circumstances two courses seem advisable: (*a*) that all government servants, and others—especially missionaries—coming into direct contact with natives should take as a part of their preparatory studies a course in anthropology; (*b*) that every government should appoint trained anthropologists, in order to make detailed investigations and to act, when needed, as advisers to the administration.[11]

Professor Myres' 1931 presidential address was delivered at a time when, as will be shortly seen, the direct application of anthropological knowledge to colonial problems had already been strongly and specifically urged. Yet in it, he comments approvingly on the decision of the Government of the Gold Coast—"one of the first to appoint an official anthropologist"—not to name a successor to its retiring anthropological officer, but to appoint selected political officers to carry on the work on the basis of further training in anthropology, these men being expected to regard their anthropological work "more in the nature of a pleasurable pursuit than of a duty." Professor Myres says:

> Here we have already, in principle the substance of all that our Institute has been recommending for so many years; and it is to be hoped that the wise decision of the Government of the Gold Coast may before long be generally adopted elsewhere.

His only other observation on this decision concerns the manner in which these data are to be utilized—and here the interests of the scholar, rather than of the man of practical affairs, are put to the fore:

> . . . With any considerable number of district officers regarding anthropological study "more in the nature of a pleasurable pursuit than of a duty," there will soon be need for someone, in the Colonial Secretariate or the Department of Native Affairs, to give his whole time to the valuable material that will be concentrated there. . . . Every Colony, too, will assuredly feel the need, in time, of some such bulletin of the more generally important items, as the *Native Affairs Department Annual* ("NADA") in Southern Rhodesia.[12]

Similarly, in the case of New Guinea, recent publications stress the importance of indirect application of anthropology to colonial problems rather than that of the professional anthropologist acting as an aide to the administrator, though government anthropologists are also employed in this region.[13]

In indirect applied anthropology, the anthropologist functions merely as a teacher. As such, he is, in any event, bound to teach all who come to him for instruction who can qualify intellectually; and there are few who teach anthropology, either in this country or in Europe, who have not had in their classes students who were to go to the far corners of the earth. As a teacher, the anthropologist gives his students the facts of primitive civilization, inculcating in them at the same time an understanding of the processes of human culture and, concomitantly, a respect for all human civilizations. Once these students leave his classes, he can not, of course, exercise control over the use they make of that knowledge. And it may well be that one factor in the development of the movement toward a more direct application of anthropology was the recognition by those who have taught prospective colonial officials, missionaries and teachers, of their inability to exert continued influence over their students once they had assumed their posts in the field.

The feeling that a direct application of anthropological knowledge, by anthropologists, offers the most

[8] This is also the case with such "applied anthropology" as is found in France.

[9] J. L. Myres, *Journal of the Royal Anthropological Institute,* 59: 19–52, 1929; *ibid.,* 61: xxv–xli, 1931.

[10] C. G. Seligman, s. v. "Anthropology, Applied," 14th ed.

[11] *Loc. cit.*

[12] *Op. cit.,* pp. xxxvii–xxxviii.

[13] E. P. W. Chinnery, "Anthropology and administration in the Mandated Territory of New Guinea" (abstract). Proceedings, 1st International Congress of Anthropological and Ethnological Sciences, London, 1934, pp. 286–287.

advantageous manner of attacking the problem of cushioning the contacts of primitive folk with European culture was crystallized in a paper from the pen of Professor Malinowski, published in 1929, and which set forth the position as follows:

It is the thesis of this memorandum that there exists an anthropological No-man's-land; that in this are contained studies of primitive economics, primitive jurisprudence, questions of land tenure, of indigenous financial systems and taxation, a correct understanding of the principles of . . . indigenous education, as well as wider problems of population, hygiene and changing outlook. Scientific knowledge on all these problems is more and more needed by all practical men in the colonies. This knowledge could be supplied by men trained in anthropological methods and possessing the anthropological outlook, provided that they also acquire a keen interest in the practical applications of their work, and a keener sense of present-day realities.[14]

That the problems indicated have suffered neglect no one would deny, and in this summons to anthropologists to attack them Professor Malinowski has performed an undoubted service to anthropology. Moreover, academic anthropologists would agree with the statement that such knowledge may be pointed toward greater usefulness to administrators, especially were the studies of the well-rounded type whose advocacy is so intimately associated with the name of the author of the above quotation. Yet, from this point onward, the realistic view of the situation—pointed particularly toward Africa, since the memorandum and much of the work resulting from it have reference to the peoples of that continent—sharply differentiates his approach from all others.

After a discussion of direct and indirect rule,[15] in which it is stated that ". . . if we define dependent rule as the control of Natives through the medium of their own organisation, it is clear that only dependent rule can succeed," the end of the government of natives is set forth: "The government of any race consists . . . in implanting in them ideas of right, of law and order, and making them obey such ideas." Therefore,

Indirect cultural control is the only way of developing economic life, the administration of justice by Native to Natives, the raising of morals and education on indigenous lines, and the development of truly African art, culture, and religion.

[14] B. Malinowski, *Africa*, 2: 23, 1929.

[15] It is impossible in the time and space available here to consider the tremendous influence that the principle of "indirect rule" of native peoples, as enunciated by Lord Lugard and extended in practice by Sir Donald Cameron, have had on the crystallization of sentiment in favor of the direct application of anthropology to administration, particularly in Great Britain. For one of the most recent discussions of the subject, see M. Perham, *Africa*, 7: 321–334, 1934.

The major portion of the discussion which follows considers the manner in which the study of the neglected problems mentioned above can be of service to the administrator. Native political organization, obviously, is of importance, and the consequences of leaving this field almost untouched are shown to have been serious in the light of administrative needs. Thus, even for the more complex African states, while these

can be allowed to run on their own lines . . . they have to be first expurgated and then controlled. Now it is essential to touch as little as possible of the established order, and yet to eliminate all elements which might offend European sensibilities or be a menace to good relations.[15a]

And it is the rôle of the scientific student of primitive politics to show the administrator what can be retained to advantage and what is to be eradicated.

Again, land tenure is basic. After sketching the correct procedure to be followed in making definite studies and stating that "it is only the anthropologist, who specializes in the study of primitive legal ideas and economic conditions who is competent to deal with this question," the advantages to the administrator of obtaining such exact knowledge are given:

Such an inquiry would not easily alarm the Native. He would often be not even aware that you are trying to take a survey of land tenure. In the second place such a survey would not only reveal the real legal rights of the individuals, it would also answer the often more important question of how the lands are used and what is the "indispensable minimum" which must be reserved for them.[16]

A similarly realistic approach is maintained toward the study of native canons of work, where the necessity of knowing the drives that motivate native labor are set forth. Mentioning the harm done by the Canadian policy of suppressing the pot-latch (numberless and even more harmful examples from American policy could also be cited), Professor Malinowski says:

Forced labour, conscription or voluntary labour contracts, and the difficulties of obtaining sufficient numbers —all these form another type of practical difficulties in the colonies. The chief trouble is to entice the Native or persuade him to keep him satisfied while he works for the white man; and last but not least to prevent the period of work having bad consequences on his health and morale as well as on the temporarily depleted village and home.

And while there are those who might not accept the statement that "the simplest experience teaches that work . . . is prima facie unpleasant," it is doubtlessly

[15a] Malinowski's footnote at this point reads: "An enlightened anthropologist or statesman has to take count of European stupidity and prejudice quite as fully as those of the African." *Op. cit.*, pp. 24–25.

[16] *Op. cit.*, pp. 31–32.

accurate that "a study of primitive conditions shows that very efficient work can be obtained, and the Natives can be made to work with some degree of real satisfaction if propitious conditions are created for them." The rôle of the anthropologist is thus suggested:

In every community I maintain there are such indigenous means of achieving more intensive labour and greater output, and it is only necessary to study the facts in order to apply efficient incentives.[17]

With the phrase "A new branch of anthropology must sooner or later be started: the anthropology of the changing native. . . ." Malinowski comes to his conclusions concerning the need for practical applications of anthropological knowledge to colonial administration.[18]

The repercussions of this memorandum were far-reaching. It was not long before a reply from a "practical man"[19] drew the author's fire in defense of his position,[20] and so effective was the defense that this same "practical man" instituted the first experiment in direct applied anthropology that has been fully reported on to date.[21]

In this experiment, which was carried on in Tanganyika Territory, an anthropologist and an administrator joined forces under the terms of an agreement laid down by Mr. P. E. Mitchell, the chief secretary of the Colony. The nature of the experiment is outlined in his introduction to the book. Assuming that the work is based on the policy of indirect rule, the administrator, in order to implement his task of carrying on an administrative system, "deriving from and resting on local organisations, loyalties, and traditions, but compelled by the supervision of a trained British staff to assure to the people proper standards of security, honesty, justice, and efficiency,"[22] asks the anthropologist questions, and the anthropologist answers them on the basis of field research.

It must clearly remain the responsibility of the administrator to decide whether to act or intervene in consequence of information so obtained, but he would be careful not to dispute, or be drawn into argument about, its correctness, for that is the responsibility of the anthropologist. The anthropologist for his part would abstain from expressing agreement or disagreement with the actions of the administrator, but not from describing their effects; he would not advocate or condemn particular courses, though he would describe their advantages or faults; his principal concern would be to answer to the best of his ability the questions put to him.[23]

With their mandate clear, then, the anthropologist and the political officer worked for a period of one year. The results, as might be expected from so short a trial, were anything but conclusive, as the authors of the report themselves are careful to state. Yet certain points do emerge from their experimentation. That every particular culture presents special problems which make it difficult to envisage the development of an applied anthropology on other than an *ad hoc* basis is suggested, and in like manner, that there are various possible kinds of applications of anthropology:

Missionaries, employers of native labour, teachers, and all others who have to deal with primitive peoples in any comprehensive manner, will have their own specific problems and will require relevant information for their solution.[24]

Still other comments concern procedures to be adopted in the field; one methodological point, however, has special significance:

It has been suggested that an anthropologist, beginning work in collaboration with the administration in a new tribal area, should be given a status which would rank him as an official in the eyes of the native. We do not believe that this would be desirable. In East Africa there might be a small initial advantage in possessing a status easily recognizable by the natives, but it would result in many lost opportunities in the end. African natives recognize as well as any one else that District Officers have duties which they can not disregard, and that they must take action on receipt of certain information; therefore many facts would be, and as a matter of fact are, concealed from them. The anthropologist suffers from no such handicap. He learns many things that natives are afraid to tell the District Officer; and the accumulation of such facts is a necessary part of the information required for a true understanding of any culture. We suggest, therefore, that the anthropologist should forego the possible initial advantage of pseudo-official rank, for the sake of the much greater advantages to come.[25]

The assumption in this frank discussion—if one may be permitted a crude illustration—is that the rôle of the anthropologist, in helping assuage a difficult social situation, is like that of the lawyer who seeks the confidence of his client, with the implicit understanding

[17] *Op. cit.*, pp. 35–36.

[18] *Op. cit.*, pp. 36–38.

[19] P. E. Mitchell, *Africa*, 3: 217–223, 1930.

[20] Malinowski, *Africa*, 3: 405–429, 1930. It is not possible in the space at hand to analyze either of these papers, or even mention the other numerous discussions provoked by them, since they have added little to Malinowski's original contentions. They are to be found, in the main, in such journals as *Africa* and the *Journal of the African Society*.

[21] G. Gordon Brown and A. McD. Bruce Hutt, "Anthropology in Action," London, 1935.

[22] *Op. cit.*, p. xi.

[23] *Op. cit.*, pp. xvii–xviii. On page 4, however, the authors state that "the administrator must accept the information as given, even if it necessitates an unexpected change in his plans."

[24] *Op. cit.*, p. 239.

[25] *Op. cit.*, pp. 235–236.

that he is to defend him, yet at the same time must furnish all privileged information to prosecution and presiding judge. The answer, of course, to those who do not admit that this is a proper rôle for an anthropologist to play, may always be that of Professor Radcliffe-Brown already quoted—that since primitive peoples under European rule have no control over their own affairs, a benevolent intervention is better than no intervention at all.

When an attempt is made to evaluate this new "direct" type of applied anthropology in terms of charting a course in this country, two questions present themselves. What can it do for the native? What effect will it have on the science of anthropology and on anthropologists?

That applied anthropology can, in certain minor aspects of cultural contact, soften the impact of conquest and its results on native peoples would certainly seem to be the case. The example of the manner in which Dr. Gordon Brown's investigation of the Hehe afforded the basis for a recommendation that a plural wives' tax be revoked and an older system of a uniform single tax be reinstated indicates how a source of irritation might be corrected.[26] Yet when we come to a possible solution of anything other than these minor problems, in situations such as are found in Africa, in the Far East, and in the islands of the Pacific, we must admit the powerlessness of the anthropologist. The administrator is there to preserve law and order among the native peoples under his control; he is there to see that the proper supply of native labor is maintained, that produce flows to the controlling country, that the colonial market for goods produced at home is preserved. In the same fashion, given all the good will in the world toward native cultures, the missionary is there to preach the truth as he sees it, and the educator to inculcate new patterns of behavior. Behind all these, moreover, is the pressure of opinion at home; nor can the attitudes which those who administer or teach have themselves absorbed from their own early training be overlooked.[27]

Perhaps it is the counsel of despair that bids the anthropologist hold off from any overt action in what are often the tragic situations which his work in the field has caused him to understand only too well. Perhaps it is the counsel of perfection that bids him hesitate because he can be so little effective in the face of the great social and economic forces that move toward the disintegration of the patterns of primitive life. Yet there is more than this. Certain assumptions which underlie the call for direct applications of anthropology to native administration may themselves be questioned. Is it not possible that native cultures have more vitality than they are credited with, and resist direction to a greater degree than is assumed? And, if so, may they not of themselves withstand the onslaught of European contact far better than is commonly held? May not the activities of the anthropologist hold only minor significance in the light of the reluctance of peoples to change their habits of life even where the attempt is made to bring about such changes under the most expert direction?

The effects of a too fervent practice of applied anthropology on anthropology as a discipline and on anthropologists must also be examined. On this point the words of a great economist may be quoted with profit:

> . . . Though we are bound, before entering on any study, to consider carefully what are its uses, we should not plan out our work with direct reference to them. For by so doing we are tempted to break off each line of thought as soon as it ceases to have an immediate bearing on that particular aim which we have in view at the time: the direct pursuit of practical aims leads us to group together bits of all sorts of knowledge, which have no connection with one another except for the immediate purposes of the moment; and which throw but little light on one another. Our mental energy is spent in going from one to another; nothing is thoroughly thought out; no real progress is made.[28]

No better illustration of this could be had than that embodied in the study of the Hehe by Dr. Gordon Brown, which though containing valuable information on certain aspects of their life, shows such gaps in several important fields, that for those who hold that to know a culture at all one must know it in the interrelationship of all its parts the work takes on a quality of expediency that materially lessens its scientific usefulness.

If we turn to the possible applications of anthropology which can be made in the United States, we must examine both the immediate and the long-term results in the light of the total situation. Our situation is unique, for we are "unembarrassed by imperial responsibilities"—to quote Professor Myres' apt phrase—that lie in the path of anthropologists in other lands. To-day in this country, as nowhere else in the world, we find government unequivocably on the side of the native. That this is true is undoubtedly due in large measure to the fact that the Indian is no longer a social or political force to be reckoned with. There are not enough Indians to allow large-scale economic exploitation, nor do they afford enough potential man-power for industry or the army to allow these factors to enter. This combination of circumstances makes it possible for the American anthropologist to work

[26] Brown and Hutt, *op. cit.*, pp. 201–204.

[27] The implications of this latter point of view have been developed in a paper by F. Clarke in *Africa*, 5: 158–168, 1932.

[28] Alfred Marshall, "Principles of Economics" (8th ed.), p. 39.

whole-heartedly with the Indian Office. Thus he is prepared to cooperate in advising on problems of land-tenure, knowing that the end in view is to obtain more land and better land for the Indians, and not to ascertain that "irreducible minimum" which can be left to the native, as is the problem of the administrative advisers in Africa. But we must have a care, nevertheless, that aid given the Indian Office does not in some future administration stimulate an urge for retrenchment that might bring about the absorption of that distinctive governmental organization of a purely scientific anthropological character, the Bureau of American Ethnology, by that other governmental agency whose concern is the practical one of administering to the needs of the Indians.

Nor must we be forgetful of that other type of applied anthropology, whose application is to our own problems. From a purely sporting point of view, so to speak, it is here that we have the best right to make ourselves heard, inasmuch as the experimental results of our advice can react only upon ourselves, and not on some primitive folk. And if our contribution at present still remains less positive than some would have it, we can make it with the knowledge that eventually it will be more positive, and surer, and when given, will carry power. One such "application" is particularly pertinent. In our university classes, the anthropological point of view is being daily presented to students who come to the subject with open minds. Whether these students be future administrators of colonies, or citizens who stay at home, the broadening influence of the realization that all human culture has its special dignity, and that the invasion of one culture by another, and the imposition of the patterns of one people upon another, is an affront to this dignity, must, in time, have its effect. Is it not here that the really important use of our knowledge can be made, rather than in the *ad hoc* advice we may, as experts, give administrators of native folk?

The answer, for the American anthropologist, must be unequivocal. The opportunity to aid those on whose side we should be ranged in the conflicts arising from the clash of cultures of unequal strength happens to make it advisable at the moment for us to grasp the opportunity to give direction to those who have the power as well as the will to better the conditions of Indian life. Let it be recognized, however, that we do this with the understanding in our own minds and in the minds of those whom we are advising that for us as scientists the search for truth must come before all else. The debt we owe the society that supports us must be made in terms of long-time payments, in our fundamental contributions toward an understanding of the nature and processes of culture and, through this, to the solution of some of our own basic problems.

OBITUARY

ALBERT SPEAR HITCHCOCK

ALBERT SPEAR HITCHCOCK, the eminent agrostologist, died on December 16, 1935, on board the S.S. *City of Norfolk,* homeward bound from Europe with his wife. He had attended the International Botanical Congress at Amsterdam as a delegate and remained in Europe studying the grass collections in several large herbaria. After a heart attack on the 14th the end came quietly, his wife beside him, on the morning of December 16.

He was born on September 4, 1865, at Owasso, Michigan, grew up in Nebraska and Kansas, attended Iowa State Agricultural College, where he was a student of Professor Charles E. Bessey and of Professor Herbert Osborn, graduating in 1884, the youngest of his class. He was appointed assistant in chemistry for 1885 and took post-graduate courses in chemistry and other sciences and continued work in botany under Professor B. D. Halstead, Professor Bessey's successor. In the fall of 1886, just 21 years old, he was appointed instructor of chemistry at the State University, Iowa City. In 1889 he gave up this position to go to the Missouri Botanical Garden, St. Louis, under Dr. W. Trelease, as instructor in botany in Washington University and curator of the herbarium.

In 1890 began his career as botanical explorer and productive taxonomist. The first trip was one of three months' duration to the West Indies, with Dr. J. T. Rothrock, of the University of Pennsylvania, and two young assistants.

In January, 1892, he was appointed professor of botany and botanist to the experiment station at the Kansas State Agricultural College, Manhattan, Kansas, remaining there nine years. Several vacations during these years Professor Hitchcock spent botanizing in Florida.

In March, 1901, he went to Washington as assistant chief of the Division of Agrostology, of which Professor F. Lamson-Scribner was chief. The work was mostly economic, and in the course of his work he traveled through the southeastern states, and from Colorado and Wyoming to the Pacific Coast.

Professor Hitchcock was assigned work on control of sand dunes, and in October was sent to Europe to investigate methods in use. He visited the dune regions of Europe and published the results in the Bureau of Plant Industry Bulletin 57.

In the brief record Professor Hitchcock kept of his years, travel is given first place, indicating how important he held it to be. He visited every state in the Union, studying farming conditions and plant geography at first hand. Until 1905 his work had been chiefly economic. In the spring of 1905 he and Professor C. V. Piper practically exchanged places. Professor Piper was in charge of the Grass Herbarium and yearned for economic work, while Professor Hitchcock carried on economic work but devoted such time as he could find to taxonomic work. An arrangement was made, satisfactory to both, by which Professor Hitchcock took over the Grass Herbarium. Beginning in 1905, a series of forty-five botanical field books gives itineraries of all his numerous botanical travels, including all parts of the United States, Cuba (1906), Alaska (1909), from Sitka to Yukon Territory, down the Yukon and north of the Arctic circle, across country afoot to Hot Springs and Nenana, Seward Peninsula, Nome—collecting in all at thirty-one stations, ending with British Columbia and Alberta. From July 5 to October 14, 1910, Professor Hitchcock, accompanied by his son Frank, who was then eighteen years old, explored Mexico. In 1911, again with Frank as assistant, he collected in the Canal Zone and Panama, Costa Rica, Nicaragua, Honduras, El Salvador and Guatemala. In 1912, with his son Albert, he botanized throughout Jamaica, Trinidad and Tobago. The summer of 1913 was spent in the western states; 1914 in the Middle West and Canada as far north as Athabasca Landing, Alberta; 1915 in the Pacific Coast and Southwest. In 1916, accompanied by Albert, he explored the Hawaiian Islands. In 1917 and 1918 only short trips were made, to the Adirondacks and New Hampshire, and from Arkansas to Colorado. In 1919, with the five children grown, Professor Hitchcock began a series of delightful trips on which his wife accompanied him, not in the field but remaining at their base, drying the collections and sharing the hardships. From October, 1919, to February, 1920, they worked in British Guiana, after spending a few days each on several islands of the Lesser Antilles. From May, 1921, to December, accompanied by his wife, Professor Hitchcock visited Hawaii, the Philippines, Japan, China, including the little known island of Hainan, and Indo-China. In May, 1923, he sailed for Guayaquil, Ecuador, spending nine months botanizing in Ecuador, Peru, Bolivia, northern Argentina and Chile, returning in February, 1924. In 1928 with his wife he worked Newfoundland and Labrador.

When, in 1929, the British Association for the Advancement of Science met in South Africa in cooperation with the South African Association for the Advancement of Science, one representative from each major science was invited as a guest from the United States. Professor Hitchcock was the botanist chosen. At the meeting he read a paper on "Grasses in Relation to Man." Following the meetings at Cape Town and Johannesburg, he visited Victoria Falls, Zanzibar and Amani Agricultural Institute, Kilimanjaro, Uganda and Lake Victoria. The visit to Africa was a continual delight to Professor Hitchcock, insatiably eager to see every part of the earth, and the gracious hospitality extended to him warmed his heart. Sailing from Mombasa he writes, "Having about two hours to wait before the departure of the steamer, I made a good collection of grasses from a hill near the dock," a mark of eager interest most characteristic of him.

During all these years, beginning with *Leptochloa* in 1903, Professor Hitchcock published a succession of scholarly revisions of grass genera, regional grass floras, and also a large number of other papers, his bibliography containing some 250 titles.

Most taxonomists of former times, notably "narrow specialists," were "closet botanists," knowing only dried plants in the herbarium. Professor Hitchcock maintained that the taxonomist must be a field worker. His collections of more than 25,000 numbers brought to light a great many species new to science and extended the ranges of many more. His observations on the habits and range of variations of grasses in the field and his wide knowledge of plant geography and special knowledge of grasslands developed a sound taxonomic judgment and the ability to interpret specimens in the herbarium.

It was just as the young Hitchcock was developing that the idea of basing names on a type specimen, instead of on authority, began to stir botanists, especially Americans. The scientific soundness of the idea appealed to him, and more than any one else he has educated the botanists of the world in the "type concept." In the introduction to his classic revision of *Agrostis* is the first clear exposition of the type method and the first discussion of types of names reduced to synonymy as well as of those of valid names. Professor Hitchcock's search for types began on his first visit to Europe, where he studied the types of American species of *Agrostis* in the Trinius Herbarium in St. Petersburg, in the Linnaean Herbarium, and elsewhere. In 1907 he spent several months in Europe visiting herbaria in Belgium, France, Spain, Italy, Switzerland, Germany, Austria, Russia, Sweden and England, seeking types of American grasses. Such an intensive quest for types had never before been carried on. Nobody knew where many of the types were. To help others in such quests Professor Hitchcock prepared a list of "Locations of Types," and multigraphed copies were distributed in 1934, with

requests for further information. A second list was distributed in 1935.

The last four months of his life were spent in herbaria at Leiden, Utrecht, Brussels, Paris, Geneva, Berlin, London, Cambridge and Oxford, seeking types of grasses in preparation for a work already begun on the genera of grasses of the world.

The Grass Herbarium increased under Professor Hitchcock's charge to at least four times what it was in 1905, until it is now the largest and by far the most nearly complete grass collection in the world. His devotion to it was demonstrated even before he came to be in charge of it. Professor Lamson-Scribner offered to sell his private herbarium, containing many of his types, but Professor Piper did not care to recommend its purchase. To keep the types in Washington Professor Hitchcock, in the presence of both men, offered to buy it. The offer was accepted, the purchase being made in February, 1905. In 1913 the Scribner Herbarium was bought by the government for the price paid Professor Scribner. The valuable agrostological library accumulated over a period of forty years he left, in the custody of the Smithsonian Institution, as a gift to the Grass Herbarium to be kept permanently intact with the herbarium.

While Professor Hitchcock specialized on grasses for the last thirty-five years his interest in the advance of botany as a whole is shown not only in the work of locating types of grasses, and other plants as well, but also in several notable addresses such as "The Scope and Relations of Taxonomic Botany," and in time-consuming service on various committees. In 1919 he was made a member of the Organization Committee for Biological Research of the National Research Council, and in 1920 chairman of the executive committee of the newly organized Institute for Research in Tropical America, remaining chairman until June, 1926. The idea of preserving a bit of tropical jungle in the Canal Zone originated with him. He pushed the project vigorously, and as a result Barro Colorado Island was made a permanent preserve.

One of Professor Hitchcock's great contributions to science was his helpfulness to colleagues in places remote from large libraries and herbaria, and his encouragement of younger workers. To the succession of students who have studied at the Grass Herbarium, he gave freely of his time and learning, but he always sought to develop independent judgment in the student. His truly scientific attitude and magnanimity were displayed in his relations with his colleagues and especially with the staff of the Grass Herbarium.

The publication of the Manual of Grasses of the United States and the fact that the first printing was sold out and a second ordered before the work had been out two months was a great satisfaction to him. Before leaving for Amsterdam in August last he finished the manuscript of a Manual of Grasses of the West Indies.

A characterization of the man could hardly be better worded than it was by Dr. Willis Lynn Jepson in the copy of his "Flora of California," presented to Professor Hitchcock in 1925: "Eager explorer, far-seeing botanist, and wise promoter of scientific research in America."

AGNES CHASE

BUREAU OF PLANT INDUSTRY

RECENT DEATHS

DR. IVAN PETROVICH PAVLOV, the eminent physiologist of Leningrad, died on February 27 at the age of eighty-seven years.

DR. CHARLES JEAN HENRI NICOLLE, director of the Pasteur Institute branch in Tunis, died on February 28. He was sixty-nine years old.

DR. GEORGE DAVID ROSENGARTEN, vice-president of the Powers-Weightman-Rosengarten Company for twenty-two years, president of the American Chemical Society in 1927, died on February 24 at the age of sixty-seven years.

DR. C. BURNS CRAIG, associate medical director of the Neurological Institute of New York and assistant clinical professer of neurology at the College of Physicians and Surgeons of Columbia University, died on February 4 at the age of fifty-two years.

SCIENTIFIC EVENTS

A HABITAT GROUP OF BABOONS FROM ETHIOPIA AT THE FIELD MUSEUM

A HABITAT group of gelada baboons from Ethiopia, a species of ape which has no counterpart elsewhere, was placed on exhibition in December in the Carl E. Akeley Memorial Hall at the Field Museum of Natural History, Chicago. The group, prepared by Leon L. Pray, staff taxidermist, shows an old male, with the mantle of long flowing hair producing a decidedly leonine effect characteristic to geladas of his age, seated on a rocky prominence. Just below him are a female and a half-grown young baboon, engaged in exploring crevices in the rock. The specimens were collected by the Field Museum-Chicago Daily News Abyssinian Expedition.

The gelada baboon, according to Dr. Wilfred H. Osgood, curator of zoology, and leader of the expedition which collected the specimens, is strictly a resident of Ethiopia, and is confined to the rock-walled canyons and high mountain crests. Apparently it has

occupied its present position in the country for a long time, perhaps almost as long as the volcanic mountains in which it lives. Its near relatives, which may have occupied other parts of Africa also, are now all extinct, and it is left alone on the Ethiopian highlands. Dr. Osgood writes:

Africa is a land of baboons, and within that continent Ethiopia is headquarters for several of the most important species. In eastern Ethiopia, mainly in the hot lowlands, are found the hamadryas baboons which extend into the Sudan and Arabia; and in other parts of the country are found also the dog-faced baboon, closely allied to forms found throughout Central Africa. The more exclusive geladas differ markedly from other baboons. Although almost wholly terrestrial in habits, the gelada has certain peculiarities indicating a possible distant relationship to tree-living African monkeys. The gelada's legs are relatively slender and the tail fairly long. On its breast is a peculiar shield-shaped naked patch of a florid pink color.

The gelada rarely descends below an altitude of 6,000 feet. In the rocks and caves where it lives the temperature frequently drops to freezing. Like other baboons, it is gregarious. It is very agile and is credited with rolling boulders from a height to disconcert any animal which may be approaching.

The hunting of geladas is extremely difficult, calling for much hard climbing, and many long shots. The baboons sighted on our expedition seemed always to perch on pinnacles from which, if killed, they would fall into such yawning depths below that retrieving them would be next to impossible. The help of the natives was invaluable in these places, for the ability of a barefooted Ethiopian to scale a cliff is second only to that of the baboons themselves.

THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

CHARLES M. B. CADWALADER, managing director of the Academy of Natural Sciences of Philadelphia, in his report for 1936 made at the one hundred and twenty-fourth annual meeting, states that the museum had the largest attendance in its history, and the greatest number of expeditions made during a single year. A program of expansion in educational cooperation with public and private schools and colleges in the Philadelphia area has been initiated.

The 181,073 visitors to the museum during 1935 represent an increase of more than 18,000 over 1934 and the 1935 attendance of school children, 37,418, an increase of nearly 23,000 over the preceding year. Of this number, more than 26,000 were Philadelphia public school pupils sent in classes by the Board of Education.

The forty-seven expeditions and field trips, to collect natural history specimens in various parts of the world, were made by friends of the academy and members of its staff. These expeditions worked in China, Tibet, Africa, Mexico, the West Indies, Guatemala, Panama, Siam, Russia, Bolivia, Alberta, Alaska, Greenland, Hawaii, Cuba, British Columbia, as well as various parts of Pennsylvania and New Jersey and in other sections of the United States.

During the year 67,000 new specimens of animals, insects, shells, plants, minerals and fossils were added to the collections, and two hundred and fifty-one of these were described by staff members as forms new to science. Seven new permanent exhibits, including the unique habitat group of Takin from West China, were installed in the museum. Sixty scientific publications by members of the academy staff were issued.

Discussing the new development program, Mr. Cadwalader said:

The last few years have seen constantly increasing evidences of public interest in our work. The trustees have decided that in order to increase the usefulness of the academy to science it must also consider the wants of the community—that if we are to proceed at an accelerated pace in our scientific departments we must capitalize upon this interest.

Accordingly, we are studying our opportunities. We have decided that there are three main divisions, which meet not only the immediate demands upon the academy and offer the greatest opportunity for service in the future, but also establish the essentials now lacking in a well-rounded program. These three divisions are first, the improvement of the museum to make it of greater educational value and also of more general interest; second, development of an active program of cooperation with Philadelphia's school children, and third, reestablishment of our department of paleontology as the first step in establishing the academy as a center of research for near-by colleges and universities.

Effingham B. Morris, president of the academy, presided at the meeting, and the following were re-elected to the Board of Trustees: R. R. M. Carpenter, Clarence H. Clark, 3rd, C. Dawson Coleman, Frank B. Foster, James E. Gowen and Effingham B. Morris. Tribute was paid to the late Prentiss N. Gray, of New York, and the late T. Charlton Henry, of Philadelphia, both of whom were members of the Board of Trustees. Announcement was made of the election of Edgar B. Howard and George D. Widener as trustees.

EXPEDITIONS OF THE PEABODY MUSEUM OF YALE UNIVERSITY

YALE UNIVERSITY has made public a report of the research projects of the museum, which includes research in Alaska, India, South America, Central America, the United States and Russia.

Dr. Cornelius Osgood, curator of anthropology, who

has devoted his research to the Far North, has completed the third of a series of Alaskan ethnological field studies. A reconnaissance was made of the lower Yukon River between the Bering Sea to Nulato, including some comparative studies among the Eskimo at Fortuna Ledge. Most of the trip was devoted to the Ingalik, an Athapaskan-speaking tribe of Eskimo, where a surprisingly rich culture which is now being studied in detail was recorded. According to Professor Osgood, this work promises to change fundamentally the present conception of these primitive people. His study carried him into Russia, where, with the cooperation of the National Research Council, he surveyed the existing materials there which are pertinent to the knowledge of the distribution and development of the aboriginal culture which spread over the whole northwestern interior of the American continent.

The Caribbean area has been subjected to an extensive archeological survey by Dr. Froelich G. Rainey, who carried on excavations in Puerto Rico under the joint auspices of the Peabody Museum, the New York Academy of Sciences and the American Museum of Natural History. This work was rewarded by the discovery of distinct superimposed strata of remains which bring a new clarification to the position of this island in its relation to the cultures of South America and those of Central America.

In the field of oceanography, the Bingham Foundation at the Peabody Museum is now engaged in developing models of deep-sea fishes. These fishes, which undergo distortion as they are brought up from the depths of the oceans, have been seen in their natural forms only by investigators who descend in special apparatus to study deep-sea marine life. Several of the models have been completed and the work will give an indication of the predominant common forms of deep-sea fishes and of the morphologically peculiar aberrant types found only in a deep-sea environment.

The foundation, under the curatorship of Professor Albert E. Parr, is completing its study of fluctuations of shallow-water temperatures along the Atlantic coast of the United States and their possible relations to the fluctuations in the abundance and migrations of marine fishes. A project in process is the investigation of the eye and optical mechanism of the flying fishes, interesting because of their need for rapid adjustment from submarine to aerial vision.

AERONAUTICS AND AIR-CONDITIONING AT CORNELL UNIVERSITY

Each year an increasing number of students at Cornell University are choosing aeronautical engineering as their specialty. The university, however, does not attempt to duplicate the work of the specially equipped schools of aeronautics throughout the country. It aims to teach the fundamentals of this rapidly expanding field to a limited group of seniors some of whom may be expected to spend a year of graduate study in one of the recognized schools for aeronautics.

A small wind tunnel built by students, capable of attaining flight conditions of twenty miles an hour for a two square foot section has served for the past few years for laboratory purposes. There is now in process of design by the students a larger wind tunnel which will use a twenty-five horse power blower to deliver 80 miles an hour on a ten square foot surface of tunnel throat.

Under the direction of K. D. Wood, assistant professor of the mechanics of engineering, the work offered in aeronautics consists of an introductory course in aerodynamics, taken in the third year, followed by courses in airplane design in the fourth year. The study of aeronautical power plants is undertaken in connection with the work in automotive design.

Supplementing the class-room instruction, the facilities of the modern airport at Ithaca are being used extensively for test flights and for calculations resulting from such flights.

A number of students have gained their student pilot licenses on the field and they form the nucleus of the Cornell Flying Club, made up of fifty members. Each year the club conducts a ground school with Professor Wood in charge.

As an outgrowth of temporary courses given this year in air-conditioning, the Sibley School of Mechanical Engineering at Cornell University will offer an option for seniors in fluid flow, heat transmission, refrigeration and air-conditioning, beginning in the first semester of 1936. This new option will be given in addition to the options now available to seniors studying for the M.E. degree in steam power-plant, industrial, automotive, aeronautical and hydraulic power-plant engineering.

The official announcement points out that these courses are regarded as particularly fitting, as Willis H. Carrier, a graduate of the School of Mechanical Engineering at Cornell University with the class of 1901, has contributed greatly to the application of scientific principles in the air-conditioning. The new option will be offered by the department of heat-power engineering, and will be in charge of C. O. Mackey, assistant professor, who has spent some time with the Carrier Engineering Corporation.

THE KANSAS CITY MEETING OF THE AMERICAN CHEMICAL SOCIETY

The spring meeting of the American Chemical Society opens at Kansas City on April 13. The sessions will be held in the new municipal auditorium. Sev-

eral symposia reporting advances in spheres of human welfare have been arranged and a group of foreign chemists will address the convention. Dr. Frank B. Dains, professor of chemistry at the University of Kansas, has been appointed honorary chairman of the local committee. Andrew S. Barada, president of Barada and Page, Inc., has been named general chairman; G. Harry Clay, of Luzier's, Inc., has been chosen vice-chairman, and James A. Austin, of the Jensen-Salsbery Laboratories, Inc., is secretary.

Professor Edward Bartow, of the State University of Iowa, president of the society, will open the general session on Monday. Seventeen divisional sections, representing practically every branch of chemistry, will take part in the meeting. Delegations from eighty local sections will attend.

The divisions and their chairmen include:

Agricultural and Food Chemistry—Dr. J. H. Nair, The Borden Company, Syracuse, N. Y.; *Biological Chemistry*—Professor C. G. King, University of Pittsburgh; *Cellulose Chemistry*—Dr. G. J. Ritter, Forest Products Laboratory, Madison, Wis.; *Chemical Education*—Professor Harrison Hale, University of Arkansas; *Colloid Chemistry*—Professor S. S. Kistler, University of Illinois; *Gas and Fuel Chemistry*—Dr. O. O. Malleis, Appalachian Coals, Inc., Cincinnati, Ohio; *History of Chemistry*—Professor Tenney L. Davis, Massachusetts Institute of Technology; *Industrial and Engineering Chemistry*—Professor Walter G. Whitman, Massachusetts Institute of Technology; *Leather and Gelatin Chemistry*—J. Harold Hudson, Eastman Kodak Company, Rochester, N. Y. *Medicinal Chemistry*—Professor R. Norris Shreve, Purdue University; *Organic Chemistry*—Professor Henry Gilman, Iowa State College; *Paint and Varnish Chemistry*—E. W. Boughton, R. T. Vanderbilt Company, Inc., New York City; *Petroleum Chemistry*—F. W. Hall, The Texas Company, New York City; *Physical and Inorganic Chemistry*—Professor J. W. Williams, University of Wisconsin; *Rubber Chemistry*—Dr. N. A. Shepard, Firestone Tire and Rubber Company, Akron, Ohio; *Sugar Chemistry*—J. K. Dale, A. E. Staley Manufacturing Company, Decatur, Ill.; *Water, Sewage and Sanitation Chemistry*—R. C. Bardwell, Chesapeake and Ohio Railway Company, Richmond, Va.

SCIENTIFIC NOTES AND NEWS

Dr. Charles A. Kraus, head of the department of chemistry of Brown University, has been awarded the Theodore William Richards Medal of the Northeastern Section of the American Chemical Society, for "conspicuous achievement in chemistry." The medal will be presented at Boston on April 10. The first medal was awarded in 1932 to Dr. A. A. Noyes, of the California Institute of Technology, and the second in 1934 to Dr. Gregory Paul Baxter, professor of chemistry at Harvard University.

On the occasion of the presentation of the Washington award to Dr. Charles Franklin Kettering, vice-president of General Motors Corporation in charge of research, a dinner was given in his honor on February 25, which was attended by six hundred guests. The citation was read by Frank D. Chase, chairman of the Washington Award Commission, after which Frank F. Fowle, president of the Western Society of Engineers, made the presentation. Dr. Kettering responded with an address entitled "Research and Social Progress."

The Worcester Reed Warner Medal of the American Society of Mechanical Engineers has been awarded to Professor Stephen Timoshenko, of the department of engineering mechanics of the University of Michigan, for his "contributions to the theory of the design of elastic structures and the treatment of dynamics of moving machinery." The medal, provision for which was made in the will of Worcester Reed Warner, honorary member and past-president of the society, is of gold. It is bestowed annually on the author of "the most worthy paper dealing with progressive ideas in mechanical engineering or efficiency in management."

The dean of the Washington University School of Medicine has announced the establishment by the Mu Chapter of the Phi Beta Pi Medical Fraternity of a lectureship to be named in honor of Professor Leo Loeb. In establishing a lectureship to bear his name, the students who compose the present membership of the local chapter of the Phi Beta Pi fraternity express to Dr. Loeb their appreciation of his stimulating instruction to them and to earlier classes of medical students and record their recognition of his important contributions to medical science.

At the regular clinical pathologic conference in the Peter Bent Brigham Hospital, Boston, on February 17, Dr. Henry A. Christian, physician-in-chief at the institution, was presented with a volume of medical papers dedicated to him by his former students, colleagues and house officers, as a token of affection on his sixtieth birthday. The presentation was made by Dr. Francis G. Blake, Sterling professor of medicine at the Yale University School of Medicine. The volume contains 1,000 pages of papers on phases of internal medicine.

Six former pupils of Dr. Alfred N. Whitehead, professor of philosophy at Harvard University, who are connected with the department of philosophy at differ-

ent institutions of learning, have written a book of essays which was presented to him on February 15, his seventy-fifth birthday. The contributors to the volume, entitled "Philosophical Essays for Alfred North Whitehead," were: F. S. C. Northrop, of Yale University; Raphael Demos, of Harvard University; Scott M. Buchanan, of the University of Virginia; Willard Van O. Quine, junior fellow of the Society of Fellows at Harvard University; Henry S. Leonard, of Harvard University; Paul Weiss, of Bryn Mawr College; S. Henry-Kirby, of Reed College; Charles Hartshorne, of the University of Chicago, and Otis H. Lee, of Pomona College.

DR. RUDOLF HOEBER, visiting professor of physiology at the Medical School of the University of Pennsylvania, formerly professor of physiology at Kiel, Germany, has been elected an honorary member of the Society of Biology at Vienna.

Nature states that fellows of the Scottish Anthropological Society have been elected as follows: Sir Arthur Keith, lately Hunterian professor of the Royal College of Surgeons of England; Dr. R. R. Marett, university reader in social anthropology, Oxford; Professor David Waterston, Bute professor of anatomy, University of St. Andrews, and Professor Herman Geijer, director of the Archive for Dialects and Folklore, Uppsala, Sweden.

R. E. DOHERTY, professor of electrical engineering and dean of the Engineering School of Yale University, has been appointed president of the Carnegie Institute of Technology, to succeed Dr. Thomas S. Baker, who resigned in September on account of ill health.

DR. GEORGE DAVID BIRKHOFF, Perkins professor of mathematics and acting dean of the faculty of arts and sciences at Harvard University during the current academic year, has been appointed dean for three years beginning next September. He succeeds Dr. Kenneth B. Murdock, professor of English and master of Leverett House, who has been on sabbatical leave during the past half year.

DR. OSKAR A. DIETHELM, associate psychiatrist at the Johns Hopkins Hospital, has been appointed professor of psychiatry at the Cornell University Medical College and psychiatrist in chief to the New York Hospital to succeed Dr. George S. Amsden, who retired in 1935.

DR. RALPH E. MILLER, assistant professor of pathology at the Dartmouth Medical School, has been appointed assistant dean of the school and has been promoted to the rank of associate professor of pathology. He has been granted sabbatical leave for the second semester of the current academic year in order to study pathology under Professor Pick in Berlin.

DR. K. H. KLAGES, of South Dakota State College, has been appointed head of the department of agronomy of the University of Idaho, succeeding Professor H. W. Hulbert, who recently resigned after eighteen years of service to join an Idaho seed firm.

PROFESSOR G. F. STOUT, who has now reached the age of seventy-five years, will retire in September from the professorship of logic and metaphysics in the University of St. Andrews which he has held since 1903.

THE retirement is announced of Professor S. W. J. Smith from the Poynting chair of physics of the University of Birmingham.

DR. JAMES H. KIMBALL, who has been connected with the U. S. Weather Bureau for the last thirty-nine years, since 1915 as special assistant to the late James H. Scarr in New York City, has been appointed to succeed Mr. Scarr as principal meteorologist and official in charge of the station in New York City.

RAYMOND ARTHUR BROWN, research assistant in the vitamin research laboratories of the department of agricultural biochemistry of the Pennsylvania State College, has accepted a position with Parke, Davis and Company, Detroit.

LORD RAYLEIGH has been elected chairman of the governing body of the Imperial College of Science and Technology in succession to the Marquess of Linlithgow, who resigned on taking up his appointment as Viceroy of India.

DR. G. H. PARKER, of Harvard University, will spend March and April of this year in work on the color changes of animals at the Kerckhoff Laboratories of the California Institute of Technology, Pasadena.

PROFESSOR DR. L. G. M. BAAS-BECKING, professor of plant physiology at Leyden, Holland, accompanied by Dr. J. Reuber, has left for an eight-months trip to Australia, India, Syria, Egypt, Tunis and Portugal to study the microbiology of salt lakes. He expects to spend some time at Madoera, Java. Dr. Becking was connected with the department of botany at Stanford University for seven years and for the last two years with the marine station at Pacific Grove, Calif.

PROFESSOR PHILIP FRANKLIN, of the Massachusetts Institute of Technology, who is spending this year at the Institute for Advanced Study at Princeton, addressed the Joint Mathematics Club of the University of Pennsylvania on "Transcendental Numbers," on February 20; and the Galois Institute of Mathematics on "The Four Color Problem," on February 29.

PROFESSOR EDWARD S. ROBINSON, of Yale University, delivered a lecture entitled "Psychology and the Law" on the Stafford Little Foundation at Princeton University on February 10.

DR. L. B. AREY, professor of anatomy and chairman of the division at the School of Medicine, Northwestern University, will deliver the Phi Beta Pi lecture at the School of Medicine of the University of Alabama, on March 13. He will speak on "Wound Healing." The lecture will be part of the program of the Southern Provincial Assembly of Phi Beta Pi on March 13 and 14.

LECTURERS of the Royal College of Physicians of London have been elected as follows: Dr. E. L. Middleton, who delivered the Milroy Lectures on "Industrial Pulmonary Disease Due to the Inhalation of Dust, with Special Reference to Silicosis" on February 27 and March 3; Dr. R. A. McCance will deliver the Goulstonian lectures on "Medical Problems in Mineral Metabolism" on March 5, 10 and 12; Dr. John Parkinson the Lumleian lectures on "Enlargement of the Heart" on March 17 and 19, and Dr. Joseph Needham the Oliver-Sharpey lectures on "Chemical Aspects of Morphogenetic Determination" on March 24 and 26.

THE tenth conference of the International Union against Tuberculosis, the secretary-general of which is Professor Fernand Bezançon, will meet in Lisbon from September 7 to 10 under the chairmanship of Professor Lopo de Carvalho.

THE second International Congress of Microbiology will be held in London from July 25 to August 1, under the presidency of Professor J. C. G. Ledingham. The honorary general secretary of the congress is Dr. R. St. John-Brooks, Lister Institute of Preventive Medicine, London.

A YEARLY visiting professorship known as the Walker-Ames professorship has been established at the University of Washington through an endowment of $450,000 left for this purpose by Edwin Gardner Ames. An outstanding scholar from this country or a foreign country, chosen for distinction in his field, will be invited to spend a year at the university and will be asked to conduct a seminar in his department for advanced students and members of the faculty and to give a series of public lectures. He will be left free to spend most of his time in study, research and writing, though it is hoped that he will enter sympathetically into the life of the university. It is planned to rotate the departments in which these professorships will be given, so that the entire university will receive the benefit of these eminent contacts. The lectures will be published in a university series. The president of the university will select the holders of the professorship after nominations have been made by the graduate council.

MR. AND MRS. HENRY PFEIFFER, New York City, have made a gift to Bennett College, Greensboro, N. C., of $97,000 for a science hall. This brings the total amount given to the college by the Pfeiffer family to $250,000. By this gift the college becomes eligible to receive $250,000 from the General Education Board.

THE honorary electrical engineering society, Eta Kappa Nu, has announced a plan of recognizing young electrical engineers for "meritorious service in the interests of their fellowmen." The achievements which will be considered in making the selections are very broad, giving considerable weight to the recommendations of the Committee on Professional Training of the Engineers' Council for Professional Development. Each candidate's career will be studied under three headings: (a) Achievements in his chosen professional work; (b) what he has done for his community, state or nation; (c) how he has shown his cultural development. As far as practicable the young engineers' accomplishments of whatever kind will be examined for an application of basic engineering methods. Members of Eta Kappa Nu, sections of the American Institute of Electrical Engineers and heads of electrical engineering departments of American colleges and universities are eligible to propose candidates. Nominees must have been graduated from a regular four-year course in electrical engineering not more than ten years on April 1, nor be more than thirty-five years of age.

J. W. WILLIAMSON, secretary of the British Scientific Instrument Research Association, will retire on March 31. *Nature* writes that on January 29 a presentation was made by the council and members of the association in recognition of the valuable services which he has rendered to the association since he became the secretary in 1918. The presentation was made by Dr. W. H. Eccles. According to the note in *Nature,* the association was established on May 23, 1918, and was the second research association incorporated by Board of Trade license, under the Department of Scientific and Industrial Research, the first of these associations—the British Photographic Research Association—having received its license a few days earlier. In the year 1917, Parliament allocated a sum of one million pounds for the promotion of industrial research, and a scheme was drawn up for the establishment of research associations connected with various industries, each of which was to receive for five years a grant on a fifty-fifty basis in aid of its expenses. The first director of research of the association was Sir Herbert Jackson, who retired in 1933, and the first secretary was J. W. Williamson.

DISCUSSION

RECENT GERMAN MATHEMATICS

EVER since the times of the ancient Babylonians, mathematicians have been creating a special language for their subject, and hence mathematics has made considerable progress towards the creation of a universal language for the literature in this field of knowledge. As an illustration we may refer to our common number symbols and to the wide-spread use of the letter x for an unknown quantity. These elements of a universal language have made it easier for the student of this subject to become acquainted with new discoveries published in other languages than his own, and have been appreciated more and more during recent decades in view of the fact that effective mathematical investigations are increasingly wide-spread among peoples employing different languages. The history of this subject presents an almost uninterrupted series of advances and in recent years international mathematical congresses have tended towards increasingly cordial relations between the mathematical investigators of various countries.

In view of these facts it is especially noteworthy that serious efforts have been made recently in one of the leading mathematical countries of the world to replace this tendency towards greater internationalism in mathematics by a strongly biased nationalism, and that for the first time in the history of mathematics a periodical has been started whose explicit object is the fostering of this nationalism. The title of this periodical is *Deutsche Mathematik,* and the first number is dated January, 1936. On the first page thereof there appears the significant statement, "Wer ein Volk zum Stolz erziehen will, muss ihm auch sichtbaren Anlass zum Stolz geben." It is too early to express an opinion as regards the effectiveness of this periodical, but its appearance represents a unique fact up to the present time in the long history of the science of mathematics.

It is interesting to note that on page 10 of this periodical Isaac Newton is called a Germanic investigator, and that on page 3 it is explicitly stated that other nations have an equal right to exhibit their national mathematical characteristics. The earlier efforts to exhibit national mathematical characteristics do not seem to have been very successful, since great differences appear in works of men of the same nation. Some of the earlier historical writers emphasized the arithmetical attainments of the ancient Babylonians and the geometrical proclivities of the ancient Egyptians, but more recent discoveries exhibit the fact that in both of these countries the arithmetic and the geometric work supplemented each other. It has also been emphasized in recent times that many earlier writers on the history of Greek mathematics emphasized unduly the geometric form in which many Greeks expressed their results, since the Greeks had a kind of geometric algebra and contributed also towards the development of arithmetic and algebra. The geometric form was often only superficial.

For about sixty-five years the Germans have published an international mathematical review entitled *Jahrbuch über die Fortschritte der Mathematik,* which has been sufficiently fair also in its reviews of the work done in other countries to be favorably regarded throughout the mathematical world. This review is being continued and improved so that the periodical to which we referred above represents only one side of the German mathematical activity of the present day. This periodical aims to include a biographical section giving a bibliography of German mathematics, and outlining all important German mathematical publications published after January 1, 1936. Its spirit seems to be in harmony with the efforts to replace international technical scientific terms by purely German ones. Lists of such proposed changes appeared in recent numbers of an elementary periodical entitled *Zeitschrift für mathematischen und naturwissenschaftlichen Unterricht aller Schulgattungen.*

G. A. MILLER

UNIVERSITY OF ILLINOIS

FOLKLORE AND SCIENCE

WHILE the person who praises every century but this and every country but his own is apt to be placed on the "list" that W. S. Gilbert refers to in "The Mikado," nevertheless it is only proper that we should appreciate the past, give credit where it is due and not scorn the base degrees by which we did ascend. May I be permitted, therefore, to draw attention to some instances where earlier knowledge than that mentioned by certain authors should be recalled?

In SCIENCE for October 11, 1935 (82: 350), Dr. C. M. McCay pointed out that in 1833 Boussingault suggested the addition of iodine to cooking salt, having found by his experiences in South America that goiter was prevalent where iodine was lacking. Dr. McCay concludes: "One can only speculate concerning the human suffering that might have been evaded if some eminent physician had noted this contribution of the French chemist at an early date." From this it might be thought that Boussingault was the discoverer of iodine therapy for goiter. The following may therefore be of interest:

Goiter was, of course, known in ancient times, and is mentioned by Pliny among others. The use of burnt sponge as a remedy was common from the latter part of the thirteenth century and was probably based on earlier folk lore. Courtois discovered iodine in 1812. In 1819 Dr. Coindret, a well-known physician

of Geneva, walked into LeRoyer's pharmacy there and asked J. B. A. Dumas (then 18 years of age) to determine for him whether sponge, especially burnt sponge, contains iodine. On receiving Dumas' report that iodine was present, "Dr. Coindret no longer hesitated to consider iodine as a specific against goiter."[1]

The *Scientific Monthly* for September, 1935 (pp. 263-5), has an article by Dr. Norman Tobias entitled "Making Malaria Work for the Doctor," in which reference is made to the work of Dr. J. Wagner-Jauregg, who received the Nobel prize in 1927 for his discovery that malarial infection may be used to combat certain nervous sequelae of syphilis. In this connection, I would draw attention to certain facts as stated in a chapter entitled "The Savage as Scientist," by Fulahn, in No. 11 of a series of books called "Tales from the Outposts," published by Blackwoods, Edinburgh.

> Kinga, who was one of the most famous chiefs and rain-doctors in East Africa, refused to be moved from his kraal at Mandi on the Daua Plateau down to Sekenke in the Wembare Plains, as medicine-man Mgendu urged; and Mgendu came to ask advice of the writer, who was then administrative officer in charge of the Iramba tribe. [Kinga was suffering from general paralysis.]
>
> Said Mgendu: "The *vidudu* of paralysis must fight with the *pilintu* of malaria so that the *pilintu* may be devoured: then must Kinga eat of the *nzizi chungu* (bitter roots), and he will be strengthened." . . . *Vidudu* are mysterious insect-like things; a *pilintu* is a strange unknown worm-like thing . . . that half-naked savage doctor was prescribing the most up-to-date medical treatment for paralysis based on the most recent discoveries of medical science. . . . Sekenke is one of the worst malarial districts in all Africa. . . .
>
> Many tribes, not only the Masai and Nandi of Kenya, knew the cause of malaria. The Somalis knew, for a British traveller in their country was told by Somali tribesmen thirteen years before Ross's discovery, that the *kan'ad* or mosquito was a bad insect, biting a man and making his blood boil with fever. Chief Kitandu of the Iramba tribe knew four centuries ago, for his minstrels sang to the twang of the *lusembi*, a primitive calabash guitar, "*Ni aza kusengila pana nu imbu; nu imbu mbii masaka masenkila!*" (Do not build huts where mosquitoes live; for mosquitoes are evil, and make your blood hot!). And that song, with others full of savage wisdom, is to be heard to this day in the kraals of Tanganyika.

I wonder whether any reader of SCIENCE can say where the statement occurs that the early British explorers, Speke and Burton, commented on what seemed to them a silly superstition among the natives of the Congo, that the African "sleeping-sickness" was associated with the coming of the tsetse fly. I remember having read of this as a boy, but can not recall where.

[1] A. W. von Hofmann, *Berichte*, 1884, 17, 637, referate.

In an address on "Biochemistry and the Manufacture of Fine Chemicals,"[2] Dr. F. H. Carr said that real scientific medicine, in so far as concerns biochemical aspects, began forty-one years ago, "when the use of thyroid gland in the treatment of myxoedema was discovered." In a paper on "The Contributions of China to the Science and Art of Medicine,"[3] Dr. Edward H. Hume, then of the College of Medicine (Yale-in-China) at Changsha, China, stated (p. 349): "Organotherapy is described as early as the 6th century, A.D., when sheep's thyroids were used for cretinism. The practice is familiar to housewives throughout the land."

In a preceding paragraph, Dr. Hume said: "Inoculation against small-pox was practised early, records being available of the transfer of virus from person to person in the 7th century, though the routine use of the method was not common until the 11th. A century before Jenner, the standard materia medica mentions the use of cow fleas for the prevention of small-pox." (Note that insect transmission is involved).

Professor J. J. Abel's isolation of bufagin and an adrenaline-like substance from the skins of toads, and our wide use of ephedrine from Ma Huang, are further instances of the fact that science very often explains or rediscovers practices long ago established.

JEROME ALEXANDER

NEW YORK, N. Y.

[2] *Chemistry and Industry*, 53: 123, 1934.

[3] SCIENCE, April 18, 1924.

THE MEANING OF "MASKING"

THOMPSON[1] has recently objected to Davis and Derbyshire's[2] use of the term "masking" to designate the phenomenon that occurs when one sound obliterates another, stating that "to call this 'masking' introduces confusion into the literature, 'masking' having already been preempted to designate a central phenomenon, postulated by Robert[3] and demonstrated (we think) by us." Thompson's experiment shows that electrical excitation of the radial nerve masks the sensation resulting from deep pressure applied to the ulnar nerve and that the mechanism of this masking is in the central nervous system.

This contention of Thompson's can not be permitted to pass unchallenged, since the term "masking" had already been in general use to designate the auditory effect for some years before it was preempted by him. Wegel and Lane[4] used the term in reporting their study on the dynamics of the ear in 1924, and defined it on the phenomenological level.

Minton,[5] in discussing an auditory experiment re-

[1] I. M. Thompson, SCIENCE, 82: 221, 1935.

[2] H. Davis and A. J. Derbyshire, *Am. Jour. Physiol.*, 113: 34, 1935.

[3] Robert, *L'Union Médicale*, 12: 487, 1858.

[4] R. L. Wegel and C. E. Lane, *Phys. Rev.*, 23: 272, 1924.

[5] J. P. Minton, *Phys. Rev.*, 22: 506, 1923.

ported in 1923, stated, "This test . . . is surely convincing proof that the masking effect described is not necessarily a function of the cochlea of the same ear . . . but may more probably be a property of the auditory nerves, or even of the acoustic centers of the brain itself." Davis and Derbyshire's recent work[2] indicates that the mechanism is peripheral. They define auditory masking as "the diminution of audibility of one sound caused by the presence of a second sound." This is obviously a phenomenological definition, and makes no implication concerning the mechanism. Troland,[6] in his "Psychophysiology" (p. 217 *ff.*) has used the term in much the same way. This usage is typical; many other cases could be cited.

Reference to Robert's report[3] reveals that he did not use "masking" in a restricted sense, for in discussing his electrical anesthesia he says "Y a-t-il eu véritablement anesthésie; ou faut-il considérer l'action de l'électricité dans ces cas comme masquant simplement la douleur?" and further mentions that "Un soufflet, par exemple, donné à un malade au moment de l'ouverture d'un abcès, masquera la douleur du coup de bistouri, etc." His conclusion seems to have been that there was "véritablement anesthésie" rather than "anesthésie de diversion" or masking.

It would seem that confusion could best be avoided, particularly in auditory terminology, by using the term "masking" when appropriate, as descriptive of a common phenomenon and without any implications as to where the phenomenon is produced.

FRANKLIN HENRY

UNIVERSITY OF CALIFORNIA, BERKELEY

A CENTRAL TREE SEED LABORATORY

THE movement to establish a central laboratory for research and testing of tree seeds and seeds of woody shrubs of all kinds is gaining impetus. The Botanical Society of America, Ecological Society of America and American Society of Plant Physiologists at their respective business meetings at St. Louis early in January, 1936, passed resolutions favoring the establishment of such a laboratory.

The need for such a central agency has been present for a long time, as pointed out by the writer in previous years. Ever since reforestation became an important activity of public agencies, and private planting increased in volume, it has become very important to know, for instance, the danger, if any, of movement of seed from different origins, and presumably different local races. The evidence is slowly accumulating that even indigenous American trees may have local adaptations, and that indiscriminate mixture of seeds of different origins not only endangers the success of plantations, but may even eventually deteriorate natural stands by cross pollination. In any case failure to start investigations into such matters 20 or 30 years ago is most unfortunate. Many aspects of seed origin investigations involve the seed itself; physiological and serological tests have been used with some success to identify seed of different origins. Since such problems are country-wide, not to say world-wide, and can be attacked and directed best from a central station, a laboratory devoted exclusively to seed studies is highly desirable.

Control of origin of seeds and certification of origin involves some sort of machinery for delimiting zones, inspection of collection, etc. Such organizations exist in many European countries, but at present no officially certified seed can be obtained in this country in spite of wide-spread foreign demand for such American seed. Legislation directed towards providing for control of forest seed origin is urgently needed. A central seed laboratory forms the logical nucleus around which a control service can be developed. Provision has been made for control of seed origin in a bill prepared for presentation to this session of Congress,[1] but none for its administration. Such a duty might properly fall to a central seed laboratory.

Shrubs and other forest plants of value as food for game have been little cultivated artificially, and almost nothing is known of the peculiarities of their seed. Recent use of such plants in wild-life sanctuaries and many rarely cultivated species in erosion control work and for shelterbelts has caused an urgent demand for information on their seed habits.

Routine testing of purity and viability of forest seeds would form an important function of such a central laboratory. Such service should be available at a regular fee to commercial seed dealers, so that the purchaser would have some guaranty of the quality of seed he purchases, and nurserymen and other consumers would have data by which to guide them in the amount of seed to use. Existing state seed laboratories handling agricultural seed have neither the equipment nor experience required for uniform results in tree seed-testing.

There are other problems, such as kiln-drying and extraction, which are peculiar to tree seeds and would naturally belong to the same organization handling seed-testing. At present each regional forest experiment station does some seed-testing, and most of them have some projects aimed at the importance of seed origin. These should be continued, but coordinated with a comprehensive national investigation. Testing can be standardized and improved only by a central agency.

[6] L. T. Troland, "The Principles of Psychophysiology," Van Nostrand, New York, 1930, pp. 397.

[1] National Forest Conservation Bill. Sec. 9, Amendment to Act of June 7, 1924—43 Stat. 653, Sec. 11.

An independent forest seed laboratory might well be located at one of the existing forest experiment stations or at the Forest Products Laboratory, Madison, Wisconsin.

HENRY I. BALDWIN

HILLSBORO, N. H.

A BIT OF ILL-CONSIDERED CONSERVATION LEGISLATION

FOR some obscure reason, when bills are being framed for submission to legislative bodies, expert advice as to plant names is usually not obtained. Every few years some organization or other sends a bill to Congress to make a certain plant the national flower of the United States, and in every case in which a copy of such a bill has come to the attention of the writer, the scientific name of a foreign plant has been attached. Thus the columbine bill specified *Aquilegia vulgaris,* which is the European species; and the daisy bill *Bellis perennis,* the English daisy. Fortunately all such bills have been referred to the Committee on Library and have never been reported out.

The states have not fared quite so well, however. Not only have several of them designated as state flowers weeds introduced from other countries, but one, Minnesota, once officially selected for its emblem *Cypripedium calceolus,* the European lady-slipper, which does not grow in that state, or, for that matter, in any part of the United States.

Conservationists have now started similar activities. On May 18, 1935, the Senate and General Assembly of the state of New Jersey enacted that "It shall be unlawful to take for the purpose of sale, sell, or expose for sale, any wild *solanum dulcamara,* commonly known as bittersweet. . . ." Actually the plant designated is a weed of waste places, the destruction of which should be encouraged because it harbors potato-beetles and other pests; and it wilts too quickly for any one to bother to sell it anyway. Had the backers of this legislation only sought a little expert advice, they would have learned that the name of the plant they really wanted to protect was *Celastrus scandens.*

EDGAR T. WHERRY

UNIVERSITY OF PENNSYLVANIA

SPECIAL CORRESPONDENCE

JOINT GEOLOGICAL AND PREHISTORIC STUDIES OF THE LATE CENOZOIC IN INDIA

Two previous expeditions to the Northwest-Himalaya had given de Terra sufficient geological data to show that Kashmir and the adjoining plains of the Punjab would yield important information on the relationship of glaciations and crustal movements to early man and his cultures. Scattered finds of some Paleolithic artifacts and evidences for Pleistocene and subrecent mountain uplifts which he had collected in 1932 seemed promising enough as to warrant a special study of this subject.

The Carnegie Institution of Washington and the American Philosophical Society at Philadelphia most generously granted most of the funds necessary for carrying out a program of research in which several institutions cooperated. Foremost amongst these was the Royal Society and Cambridge University, who enabled Paterson to collaborate, and Yale University. The Geological Survey of India, by kindness of its directors, Sir Leigh Fermor and Dr. A. M. Heron, lent the valuable assistance of Mr. N. K. N. Aiyengar, whose task was not only to gather additional fossil material of the Siwalik fauna, but especially to collect fossil primate remains. The expedition leader asked Dr. P. Teilhard de Chardin, of the Cenozoic Research Laboratory in Peiping, to participate, and his association, which lasted shortly over three months, was of the greatest assistance. Mr. D. Sen, of Calcutta University, acted as field assistant, and temporarily Mr. H. J. H. Drummond and Mr. Krishnaswami associated themselves with our party.

Naturally the investigations had to be based on a careful stratigraphy of the Pleistocene. The glacial cycle in Kashmir, which, in a general way, had previously been recognized by Giotto Dainelli, provided an ideal means by which it was possible to work out a standard sequence of geological events for the mountainous tract. Such data could then be used in correlating the late and post-Siwalik formations of the adjoining foothills and plains with the glacial and interglacial deposits in the north. This in turn would enable us to date any prehistoric cultures found *in situ,* and also to check the stratigraphical results thus gained against the paleontological records on which had previously been based the stratigraphy and age of the Siwalik formations.

The work in Kashmir was carried out in this way, that Paterson undertook a survey on the Himalayan slope of the Kashmir basin, and in the foothills of Poonch, while de Terra studied the basin filling and the southern flank along the Pir Panjal down to the plains at Jammu. Pleistocene geology centers here around the glacial cycle. Its evidences were found in the morphology of the glaciated valleys and in the sedimentary records of both glacial and interglacial stages.

Composite valley slopes clearly revealed the scooping effects of at least three different periods of valley glaciation and they also showed that the respective valley floors of the various glaciers had successively been eroded by streams with strong erosional power. This intense erosion mainly took place during the first and second interglacial periods, at which time the drainage experienced rejuvenation due to uplift. A set of five terraces permitted us to recognize the effects of this glacial cycle even at places where typical moraine deposits are missing, but in the valleys the terraces are always connected with the three last ice advances and the respective interglacial periods. The topmost terrace was found cut into the moraine and outwash deposits of the second glaciers, and for various reasons it must be of second interglacial age. The lower terraces (2, 4, 5) are made of boulder gravel belonging to the outwash activities of glacier streams of the third, fourth and fifth ice advances. Terrace 3 was seen to cut into the morainic debris left by the third glacier and therefore should belong to the third interglacial.

The various terminal moraines, however, form the strongest evidence for the glacial cycle. Their position in the valleys is such that the lowest (at 5,400 feet) marks the first and oldest, and the highest (at ca. 9,000 feet) the youngest of the ice advances. The moraines of the second glaciers were deposited into a lake and are therefore represented in the form of boulder conglomerates and a "boulder clay" which separate the lake beds of the first and second interglacial period. This lake filled the Kashmir basin and the valley outlets and it existed from the first until the beginning of the second interglacial. This dating became possible only after a thorough mapping of the valley outlets was made where the lake beds overlie the lowest moraines and the oldest fluvio-glacial outwash gravels. The first interglacial thus was recorded through deposition of the "lower Karewa lake beds," which de Terra found to be highly fossiliferous at many places. With the kind assistance of Dr. R. Stewart, of Rawalpindi, and Aiyengar, some 800 fossil plant specimens were collected and in addition fish and mammalian remains (*Elephas namadicus, Cervus*). The flora is at one place characterized by the prevalence of pine and oak, at another by the combination of birch, beech and willow, which would indicate a cold temperate climate. Plant-bearing lake beds were even found on the crest of the Pir Panjal range at 11,200 feet, to which height they can only have been carried by continuous uplifts which occurred during the three interglacial periods. On the Kashmir side these lake beds are unconformably overlain by ground moraines and redeposited morainic outwash of the second glaciers. In the mountains large glacial trough-valleys and thick moraines testify to the intensity of the second glaciation. The latter was preceded by strong uplift and folding of the lower Karewa beds, which took place at the close of the first interglacial. The upper Karewa beds consist of the glacial conglomerates and overlying lake beds, and both were folded in connection with another uplift of the Pir Panjal range, which event presumably caused the lake to be drained off through the Jhelum valley. Subsequent erosion was very intense and into the newly carved relief advanced the glaciers of the third glaciation. Because of the steep valley gradients these glaciers attained in the Pir Panjal such momentum that they descended farther into the lowlands than the glaciation would normally have admitted. They left sets of terminal moraine walls which generally consist of from 3 to 4 moraines. The fourth and fifth ice advances left moraines 2,000 or 4,000 feet, respectively, below the limits of present glaciation.

These data, which permit of recognizing a glacial cycle and its dependence on contemporary diastrophism, provided us with a key to the understanding of the late Cenozoic history in the adjoining foothills and plains.

Along the Tawi River in Jammu de Terra observed that the ground moraines of the second glacier gradually merged into the "Boulder Conglomerate" of the Upper Siwalik group, which here contains faceted boulders. Paterson independently found the same relationship in Poonch. Through this principal fact the late Siwalik history of the Himalayan foothills became linked with the glacial cycle. A joint excursion to the Pleistocene basin of Campbellpore, near the Indus below Attock, revealed that the "Boulder Conglomerate," which here contains erratics, unconformably overlies a tilted series of conglomerates, sandstone and brown- and orange-colored silt or clay. In its upper portion this series contains a rich vertebrate fauna in which *Equus, Bos, Bubalus, Cervus, Felis, Hyaena, Stegodon* and *Elephas* figure prominently. This fossil association indicates an early Pleistocene time of presumably Pinjaur age. The basal layers recall the composition of the Upper Siwalik "Tatrot stage." Teilhard and de Terra took occasion to study this stage in numerous exposures, as at Tatrot, Bhaun, Dina and in the Soan valley, while Paterson surveyed it in Poonch and Mirpur. They received the impression that the Pleistocene generally began with a differentiation of the relief into single basins, in which the Tatrot-Pinjaur series unconformably overlie the Dhok Pathan rocks, while the "Boulder Conglomerate" everywhere covers the folded early Pleistocene beds. It is this composition and structure which the Punjab sequence has in common with the Kashmir Pleistocene.

In the Potwar region near Rawalpindi and in Poonch the second glaciation was followed by a long erosional interval which in turn gave place to the deposition of a thick series of loess-like silt and clay. This Potwar formation covers the older relief with its fluvial and lacustrine sediments into which terrace 3 was cut during the third interglacial. This observation induced us to date the Potwar silts as third glaciation.

In the Pleistocene between the Salt Range and the Indus Valley we found numerous prehistoric cultures. Large waste flakes were found in the "Boulder Conglomerate" in a worn state. The oldest definite industry, however, consists of a series of massive choppers, scrapers and hand-axes which seem to be ancestral to a middle Paleolithic industry discovered by de Terra on the Soan River near Rawalpindi. Because of its distinct facies he has called it the "Soan industry," and related industries ranging from the beginning of the second interglacial into the third glaciation will probably constitute a definite Soan culture. Associated with the earlier Soan industries are rolled Chellean and Acheulean bi-faces and cleavers, and it would seem that the Soan culture extends in prehistoric chronology from Chellean to upper Paleolithic, the latest industries being very reminiscent of the Asiatic Aurignacian of Europe, as pointed out by Drummond. The wide-spread occurrence of this culture along ancient drainage channels suggests that the Soan people utilized the valleys for their migrations, and the peculiar character of their implements perhaps may indicate a people distinct from that of the Acheulean core-tool manufacturers of southern India.

The Neolithic in the Punjab is represented by stray samples of "celts" and tools of soft sandstone. A megalithic culture was unearthed in Kashmir, where the expedition leader undertook a trial excavation which brought to light a number of polished greenstone axes, knives and bone implements. In association with these appeared a very primitive type of handmade pottery with nail marks and grass-matt design which antedates a black burnished ware that also occurs in the lowest layers at Mohenjo Daro (Upper Sind). Paterson also found the same type in a midden in the Sind valley. This pottery may be associated with the megalithic culture, and it appears to represent a very ancient Indian civilization.

In order to enlarge and test our opinions on Pleistocene stratigraphy and prehistory in India, we used the last month for a visit to various places of interest. The first two authors went to Upper Sind and then to the Narbadda valley in Central India, while Paterson and Drummond visited the museums at Lahore, Benares, Calcutta, Trivandrum, Colombo, Madras and Bombay, field work being carried out in the last two districts. At Rohri and Sukkur in Sind were found a variety of rich workships of Acheulean-, Soan- and Neolithic peoples. The tools are well worked in flint, but almost all were found on the surface, as remnants of Pleistocene deposits are scanty. In the Narbadda valley, however, fresh and rolled Acheulean implements were found in association with the Narbadda fauna, of which we collected *Equus namadicus, Bos namadicus, Bubalus, Cervus, Hippopotamus* and other forms. Here the early Paleolithic industry occurs in a lower group of conglomerates, sands and clays which we are inclined to equate with the "Boulder Conglomerate" stage. Some Soan industries appear in the upper group in association with the same fauna and rolled early Paleolithic tools. A great disconformity separates both groups, of which the upper one is most probably homotaxial with the Potwar silts of the Punjab. A Chellean workshop was found near the rock shelters of Hoshangabad, where prehistoric paintings occur.

In the museums mentioned above the collections showed a wide-spread occurrence of a primitive and proto-Neolithic culture which may be derived directly from the upper Paleolithic, of which only the Soan facies seems to be at all prominent, the European and African types being almost completely absent. The early Neolithic is akin to that of northern Europe, though there occur types similar to the latest upper Paleolithic of North Africa. An extensive microlithic industry, generally in semi-precious stones, was studied.

In Madras the great mass of the low-level laterite seems to have been deposited on a conglomerate or an associated sandstone or grit, which, according to the prehistoric remains, may be equated with the "Boulder Conglomerate" of the Punjab. The mixture of industries and cultures in the laterite is attributed to subaerial washing and rewashing of the laterite and the gradual burial of the artifacts. Three terraces were observed, the upper two of which can probably be assumed to be of the same age as terraces 2 and 3 of the Punjab by reason of the Soan industries found in and on them. Several very rich sites were found, and in most cases the Soan culture predominated. The accurate dating of the latter in the Punjab will be of great assistance in a study of the Pleistocene throughout India, for, as the museum collections show, this culture occurs in most regions between South and North India. At Khandivli, near Bombay, an implement-bearing site discovered by Lt. Todd, R.I.M., showed a subaerial deposit alike in age to the laterite of Madras. Gravels carrying later Soan industries, and clays which may be homotoxical with the Potwar, overlie this earlier deposit.

Aiyengar's fossil collecting in the Salt Range, in Jammu and in the Simla Hill states resulted in a good representative collection of Siwalik fossils. Amongst these a substantial collection of fossil primate remains will make a welcome contribution to the present scanty knowledge of this higher anthropoid group.

Most of the fossil material was sent to the United States for investigation, while the prehistoric material, numbering some 4,000 specimens, was placed under the care of Paterson at the Archaeological Museum of Cambridge University. It is planned eventually to distribute the collections between Yale and Cambridge Universities and the Indian Museum in Calcutta.

H. DE TERRA,
Leader of the Expedition
P. TEILHARD DE CHARDIN
T. T. PATERSON

SCIENTIFIC BOOKS

SANITARY ENGINEERING

Elimination of Taste and Odor in Water. By JOHN R. BAYLIS. pp. x + 392, 85 figs. in text, 88 tables, chapter bibliographies, index; 9 by 6 inches. McGraw-Hill Book Company, Inc., New York and London. 1935. $5.00.

FOUR national engineering societies, the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and American Institute of Electrical Engineers, have made arrangements for the production of books adjudged to possess usefulness for engineers or industry, but not likely to be published commercially because of too limited sale without special introduction. The first of these Engineering Societies Monographs is written by the physical chemist of the Division of Water Purification of the Bureau of Engineering, Department of Public Works, of the City of Chicago.

The esthetic qualities of potable waters reside not only in their color and clarity but also in their freedom from objectionable odors and tastes. These last-named qualities have various origins. Many have a natural origin, either organic or chemical, while others arise from industrial pollution which in turn may combine with, increase or decrease those occurring in nature. The author lists thirty-six adjectives descriptive of tastes and odors, twenty of which are traceable to organisms. These are mainly synthetic green algae, blue green algae, diatoms, colored flagellates and plants which may produce volatile essential oils; or more rarely molds, bacteria and occasionally microscopic animals of the plankton or larger attached animals, such as sponges and bryozoans in water mains. The death of plankton organisms occurs in distributing systems, and their decay is rapid because of the ratio of their surface to their volume. Their numbers per cubic meter in reservoirs are subject to the rhythm of seasonal and photic fluctuations and they multiply a hundred fold or more in a very short time, thus giving rise to sudden flares of quite perceptible odors and tastes, some of which are esthetically objectionable. No water supply exposed to light escapes this organic source of odors and tastes.

Chlorination of water supplies before admission to the water mains for the removal of the possibility of contamination with pathogenic bacteria often leaves a chlorinous taste in the water at the faucet. Few, if any, streams escape industrial and sewage pollutions, some of which persist for a long time with little change except by dilution.

The sanitary engineer who seeks to maintain a municipal water supply in a uniform state of minimum odor and taste may prevent some invasions by inspection for pollution, by treatments with copper sulfate or chloramine to destroy algal growths, by precipitation and filtration to remove substances and organisms from the water, but any one or even all of these treatments are inadequate to insure continuous freedom from objectionable tastes and odors. The engineer therefore is compelled to seek some easily operated system, using inexpensive materials not subject to quick exhaustion which will uniformly remove the exceedingly varied chemical substances from the water before it enters the water mains. This book explains the use of activated carbon for this protean task.

The first chapter deals with the sources of odors and tastes and the methods of their detection and quantitative measurement. The apparatus for detecting odors in cold and hot samples by seriated dilutions with standard odorless water are elaborate and ingenious. It seems probable in the light of known variations in the sensitiveness of the individual and the amplitude of individual variations among different observers that both qualitative and quantitative variations will somewhat reduce the comparative values of such tests. If applied uniformly by a single observer of proven sensitiveness to slight differences in amounts of the various substances concerned, these tests may, however, have a high practical value in regulating the processes of control by the methods described in this book.

The industrial uses of activated carbon are an indirect result of the use of irritating and lethal gases

in the world war, especially in gas masks. While chlorinous tastes may be removed by the use of ammonia, practically all other tastes and odors generally may be removed by activated carbon. It was introduced to remove odor and taste from water supplies in 1930. By the end of 1932 over 400 plants were using it, and the development of the process and of specialized equipment for its use has grown rapidly in recent years.

The greater part of the book is given to technical accounts and discussion of subjects such as charcoal and activated carbon, physical and chemical properties of activated carbon, experiments in the removal of taste and odor in the laboratory and in the operation of water plants, handling and applying powdered activated carbon and granular carbon in small and large units, dechlorination with carbon, tests and specifications for activated powdered and granular carbon and quantitative phenol determinations and their reliability for evaluating carbon.

Consideration is also given other methods of water purification than that by activated carbon, such as the ammonia-chlorine treatment for sterilization, prevention of chlorinous tastes and superchlorination followed by dechlorination for removal of tastes and odors. Aeration, ozonation, permanganate and bleaching clays are also discussed.

The book is a mine of information on principles, tests and practices in this very important and very recently developed field of sanitary engineering. Its material is well organized, the text is clearly written, the illustrations are clearly labelled and structurally differentiated and the numerous tables are carefully headed and legibly set up. Typographically and in make-up the book is a credit to the publishers. On the whole it is a fitting exemplar to initiate the Engineering Societies Monographs.

Charles Atwood Kofoid

University of California

VITAMINS

Vitamins in Theory and Practice. By Leslie J. Harris. The Macmillan Company, New York, 1935.

The standard books and reports on vitamins are already largely out of date. This in itself would make the book under review a welcome addition. When it is added, however, that besides being up-to-date, the book is delightfully written and that it is authoritative (the author is head of the Nutritional Laboratory at Cambridge), we have a most valuable addition to current vitamin literature.

If an author steers clear of the chemistry of the vitamins—and Dr. Harris barely touches the subject—it is possible to write a "popular" account of these substances without any material sacrifice to even extreme accuracy. In this respect certain aspects of nutrition stand apart from several branches of science. The book before me, an outgrowth of a series of lectures delivered at the Royal Institution, is, within its compass, sufficiently scientific to be of value to every biochemist; and so fascinatingly written that it should appeal to thousands of others.

The first part of the book deals with the history of vitamin discovery. Takaki and Eijkman and Funk and Hopkins and McCollum, among the pioneer hunters, get the credit they so richly deserve. Incidentally, Funk, "the originator of the vitamin theory" and an early worker on the chemistry of Vitamin B, is here for the first time given that commanding position in the development of the subject which rightfully belongs to him. Incidentally, also, we learn that, though Eijkman did his work on beri-beri during the years 1890–1897, it took the Stockholm committee (and the scientific world at large) some 30 years to decide that the Dutchman's contribution was worthy of a Nobel prize.

In the chapter on "How Many Vitamins Are There?" the author very conservatively (and very rightly) limits himself to 6, for the time being. With but one exception (vitamin E)[1] the chemistry of these substances has been incredibly advanced during the last five years. One vitamin (C) has even been synthesized. The structural formulas of three others (A, D, B_1) are reasonably above suspicion. The time seems not far distant when the chemist will no longer find it necessary to have a supplementary chapter on vitamins and other unidentified substances, but will include the vitamins, at least, under such headings as alcohols, sterols, pyrimidines and sugars.

Under vitamin B_1 we find, unfortunately, no mention of Clarke's and Williams's beautiful work on the chemistry of this substance. As for its function, the author stresses the fact that in its absence too much lactic acid accumulates in the body, poisoning the heart muscle and the central nervous system; which implies that vitamin B_1 may be a co-enzyme for lactic acid oxidation.

Harris quotes the U. S. Census Department to the effect that in 1930, 7,000 people died of pellagra in this country. "The explanation is economic, not scientific . . . the food is to blame." In the Southern states, the "pellagrins" (mainly Negroes) subsist largely on maize-meal (corn-meal), molasses and meat (salt pork)—the three m's; and they suffer from dermatitis, diarrhoea and dementia—the three d's.

One would anticipate from the very structure of vitamin C that it plays a rôle in the oxidation-reduction system of the body; but just how it fits into the scheme of complex systems in the body is highly

[1] In the February number of the *Journal of Biological Chemistry*, Professor Evans and his coworkers report the isolation of an alcohol from wheat germ having the properties of vitamin E.

problematical. The excessive bleeding and the faulty tooth structure are correlated with a lack of the proper function of certain cells. In this chapter, incidentally, we are told the best vitamin story of the year. It would seem that when Szent-Györgyi first isolated and analyzed vitamin C, he came to the conclusion that it was a sugar, but he failed to identify its exact nature; so he gave it the tentative name "Ignose." The editor of the journal to which Szent-Györgyi sent his article "suspected a flavor of levity" and requested the Hungarian to suggest another name. "God-knows," came the prompt reply.

Harris contrasts the action of vitamin D with that of the parathyroids by pointing out that whereas the former helps to keep sufficient calcium and/or phosphorus in the blood by improving their assimilation from the food, the parathyroids draw the calcium out of the bones. In hypervitaminosis there is an excess absorption of calcium and phosphorus, with a consequent excess of Ca and P in blood, and an ultimate over-calcification in the newly forming bone.

The Germans still persist in calling rickets *die englische Krankheit;* which is time that the English people return the compliment by referring to a far more virulent disease now rampant in Germany as *die hitlerische Krankheit.*

The author claims that xerophthalmia, due to a lack of vitamin A, is so common in Ceylon that two thirds of the cases of blindness in children are due directly to it. The night-blindness in grown-ups (common in Newfoundland, Labrador, China, Brazil, etc.) is associated with a lack of this vitamin. The "visual purple," a pigment found in the retina of the eye, is necessary for proper eyesight. A lack of vitamin A in the diet causes this pigment to disappear and to reappear again when vitamin A is supplied. Harris is of the opinion, however, that the most important function of this vitamin is to prevent the cells of the mucous membrane from degenerating. In the absence of vitamin A the cells undergo a metaplasia and the mucous membranes become "dried up." These properties of vitamin A (and, of course, of β-carotene) are related to the "peculiar double-bond system presumed to be present in the molecules of both carotene and vitamin A."

The so-called "anti-infective" property of vitamin A, around which fortunes are being built by unscrupulous promoters, is very properly blasted. Harris's colleague, Dr. Moore, has even shown that people might die from all kinds of infectious diseases despite ample vitamin A reserves!

The relation of sterility in man to vitamin E is still a closed book. Even rat and mice experiments should afford little comfort to Hitler or Mussolini. Extra quantities of vitamin E do *not* increase the fertility beyond the normal limits, despite C.H.A.'s jingle:

> We'll double the birth-rate yet, my dears
> If we all eat vitamin E.
> We can blast the hopes of Maria Stopes
> By taking it with our tea.

The concluding portions of the book are devoted to practical dietetics. Harris very modestly implies that he probably knows more about proper diet than the mother "who ought to know something about babies, her having buried seven." The value of instinct as a guide comes in for some pertinent criticism. When you are rickety or anemic, instinct will hardly lead you to sources of vitamin D or iron. Harris does admit (based on his own experiments) that animals are sometimes able to learn to choose the right food. "The essential is that the food must produce a noticeable immediate effect (or reward) which the animal can experience, and that the food must possess some distinctive odor or taste or appearance by which the animal can recognize it again next time."

Without giving elaborate (and meaningless) specific directions, Harris suggests that the "ideal diet" must include a varied diet; it must contain a daily protein dish (meat, fish, eggs or cheese), it must contain daily fresh fruit or salad (vitamin C), and it must not be milk-sparing. The "ideal infant diet" should be built around milk, supplemented by vitamins D and C (orange juice) and iron.

Such advice can be heeded by the "middle" and "upper" classes. Often, with the best of intentions and with no lack of intelligence, the "lower" classes, with their limited means, find themselves in a hopeless situation. "The fault," writes Harris, very justly, "is not with science, but in the existing maladjustment of our social organization."

Sir John Orr, in an address before the British Association some months ago, claimed that one half of Britain's population could not afford an adequate diet. This nation represents a flower of Western civilization. We can but surmise conditions in China and India.

The scientist points the way, the politician talks nonsense, and the world is where it is.

BENJAMIN HARROW

STRUCTURAL GEOLOGY

Structural Geology, with special reference to economic deposits. By BOHUSLAV STOČES and CHARLES HENRY WHITE.

THE authors of this work are mining engineers and have approached their subject from the point of view of applied geology. This is implied in the subtitle and is expressly stated in the preface. A geologist,

looking for discussion of the subject indicated by the major title, "Structural Geology," has therefore no ground for disappointment if he finds but scant consideration given the topics usually comprised under that head.

The treatment in this volume of four hundred and odd pages is purely descriptive. This being the method, approximately two thirds of the space is given to illustrations, which are well selected and well reproduced, and but one third or less to the very brief text. Primary structures of sedimentary and igneous rocks are described in the first 100 pages. Stratification, interbedding, reefs, talus, placers, glacial drift and "characteristics of sedimentary mineral deposits" are curiously associated with elementary illustrations of structures. The important subject in quotation marks above is dismissed in two thirds of a page of text. Under igneous rocks we find a brief list of intrusive and extrusive forms, supplemented by 10 pages of description and 30 pages of illustration. The text and illustrations relating to orogenic movements occupy 4 pages. Next comes a chapter on folding, 62 pages, and another on faulting, 91 pages, in which the structures are described in considerable detail, but not analyzed as to possible conditions of stress and strain. The omission of any discussion of mechanical principles as applied to rock deformation is in the opinion of the reviewer to be regretted by engineers, since it is of vital importance in mining operations.

We have now reached the last third of the volume. In the few pages given to partings in rock masses joints and cleavage are used as synonymous terms. The confusion of thought suggests the almost forgotten controversy between Van Hise and Becker. Under the heading "Veins" two major classes are distinguished, namely "endokinetic" and "exokinetic." The subject is treated in 7 pages of text with 33 of illustrations. The latter part of the work comprises an account of structures in folded and faulted regions, with emphasis on European interpretations and some repetition of earlier chapters. The remaining items are: Igneous activity and mineralization, 1 page; surveying and mapping, 16 pages including illustrations, geophysical methods, 21 pages; influence of structure on mining, 17 pages; glossary, bibliography and index.

The writers of this book are eminent in their profession, both in teaching and practice. Their careers have been long and successful. But their contemporary in reviewing their work is reminded of the geologic dogmas of past decades, before the masters of geology in America challenged them and aroused the critical and progressive spirit of inquiry that characterizes our scientific attitude to-day. Having consulted a number of teachers in eastern and western universities the reviewer believes that he expresses a consensus of opinion in saying that the text is inadequate and elementary, but some of the illustrations will be found to have significant value for those who seek examples, especially of ore deposits.

Bailey Willis

SPECIAL ARTICLES

BRAIN POTENTIALS DURING HYPNOSIS

In a previous communication we have distinguished three types of waves (rhythmic electrical potentials) which could be recorded from electrodes placed on the head of a normal adult person.[1] For convenience of description and because of their characteristic appearance, we have named them as follows: (a) "Trains." These appear as trains of waves lasting from 1 to 30 seconds. Their frequency for each individual appears to be relatively characteristic, usually about 10 per second. They were first described by Berger[2] and are called by Adrian[3] the Berger rhythm. (b) "Spindles." These appear only during deep sleep, usually last less than a second, and are not nearly as numerous as the trains. Their usual frequency is about 14 per second. (c) "Random." These are irregular potential waves with no characteristic frequency appearing during sleep.

When a person is going to sleep the trains persist for some time, but become less and less frequent when drowsing, gradually changing over to the random type. After some time the spindles usually begin to appear. The spindles are so characteristic of some individuals that their occurrence has been accepted as an objective criterion of deep sleep. If the subject is disturbed, the spindles immediately cease and the trains usually appear at once.

In order to compare hypnosis with sleep, one of our subjects was studied under hypnosis. He was brought to the laboratory by Dr. David Slight, of McGill University, Montreal. The subject had been hypnotized many times before. He was first tested awake and during normal sleep and showed characteristically normal trains of 9.9 per second and spindles of 12.5 per second frequency. After Dr. Slight had induced the hypnotic state, a sustained condition of cataleptic rigidity ensued. Nevertheless, the trains characteristic

[1] Loomis, Harvey and Hobart, Science, 81: 597, 1935; 82: 198, 1935.
[2] Berger, *Arch. f. Psychiat. u. Neur.*, 1929–35.
[3] Adrian and Matthews, *Brain*, 57: 355, 1934; Adrian and Yamizawa, *Brain*, 58: 323, 1935.

of a person awake remained at all times during hypnosis and no spindles or random waves (characteristic of normal sleep) appeared during any of the tests. It would seem that the term hypnotic "sleep" is not a correct one for the hypnotic state, at least as measured by this criterion.

The "trains" of waves, with their characteristic frequency appear in normal subjects most regularly and continuously when resting quietly and comfortably with eyes closed and the "mind at peace." Opening the eyes stops the trains if the room is not completely dark. If the eyes are kept open continuously in a dark room trains will appear and disappear as a minute point of light is flashed off and on. This light may be so faint that it can only be seen with thoroughly dark adapted eyes.

We wished to test whether it was possible to produce and record temporary blindness induced by hypnotic suggestion. The subject's eyelids were fastened open with adhesive tape and he was hypnotized. After giving the subject careful instructions, Dr. Slight suggested alternately every 15 seconds that he could see and that he was blind. This was repeated a large number of times. In every case trains appeared when the suggestion was made that he was *blind,* and in every case they ceased when the suggestion was made that he could *see.* This was true both when there was a light in the room and when the room was in total darkness.

The trains of a normal person, unhypnotized and who never had been hypnotized, tested in a completely dark room, will stop if it is suggested that he sees something, a light or a face. We have never been able to start trains by suggesting to a non-hypnotized subject that he sees nothing when his eyes were open in a light room.

Emotional disturbances, such as extreme embarrassment or anxiety and apprehension, will usually stop the trains. Adrian has suggested that these waves should be absent in a blind person. He believes that he had confirmed this conclusion on three subjects that had been blind for some years. Our interpretation of these results is that these blind persons were emotionally disturbed because of the strangeness of the tests. We have found that many persons before they have become accustomed to the electrodes and their strange surroundings, show few or no trains during the first hour or so.

One of our subjects had been blind since birth. When he was first tested, practically no trains were evident. Later in the day, when the subject was thoroughly at ease and after he had confessed that he was no longer apprehensive, regular trains appeared until he had been asleep for some time, when the waves became random followed by the characteristic "spindles." While asleep, a cough outside the room (which he remembers hearing and which evidently slightly awakened him) again gave rise to continuous trains lasting for six minutes. Such behavior is quite characteristic of a person with sight, and in no way have we found the potentials of this blind subject to differ from a normal person. The frequency of his trains were 11.7 per second. His spindles were 14.5 per second.

It is not possible in this brief note to give proper credit to the findings of Berger,[2] Adrian,[3] Kornmüller,[4] Jasper,[5] Davis,[6] and others, but an adequate explanation of the "trains" must take into consideration the following characteristics which we have observed and to which we direct special attention. Twenty-eight different persons have been studied, all for at least 2 hours, one for an aggregate period of 50 hours.

(1) *Variability.* A marked difference among normal adults in regard to the appearance of these trains. Under the most favorable conditions, and considering a period of an hour, we have seen subjects where trains were present at least 90 per cent. of the time, and other subjects where only a few bursts occurred during this time, and still others in which no trains appeared, although different frequencies might be present.

(2) *Age.* We have never seen them in babies. Three babies, ranging from 17 to 126 days old, gave only random potentials. In young children the tendency is for low frequencies to appear. Two identical girl twins 27 months old gave records identical in general character with large "saw tooth" potentials of 4 to 5 per second, whereas a girl 28 months old from another family gave a very different type of record with 7 to 8 cycle potentials. Boys 4 years old gave 8.5 cycle potentials and boys of 15 years gave records similar to adults. Trains were well marked in a man of 74.

(3) *Regularity.* Trains are so regular in their phase and frequency in some persons that a sharply tuned amplifier responds well to them. We have found the use of an amplifier tuned to particular frequencies very convenient for picking out rhythms otherwise obscured by superposed waves which show in the record from the untuned amplifier.

(4) *Change in frequency with rest.* In every case where we have had a subject lying quietly for two hours or more, the frequency of the trains was from 5 per cent. to 10 per cent. slower at the end of the period than at the beginning.

[4] Kornmüller, *Biol. Rev.,* 10: 383, 1935.

[5] Jasper and Andrews, *Jour. Gen. Psychol.,* 14: 98, 1936.

[6] Gibbs, Davis and Lennox, *Arch. Neur. and Psychiat.,* 34: 1133, 1935.

(5) *Disturbance.* When the trains are appearing most continuously they nevertheless are interrupted ery few seconds by some sort of disturbance. This sturbance may interrupt the trains coming from one rt of the head without stopping those from another rt.

(6) *Mental activity* as such does not seem to affect e trains. A person may be read to, converse or do mple problems in mental arithmetic, without affectg the trains.

(7) *Emotional states* seem to have a profound effect pon the waves. If a subject is embarrassed or apprensive practically no waves appear. The trains can sually be stopped if a subject is asked to solve a ifficult problem in the shortest possible time (that is, he becomes "rattled"). One subject could stop his rains at will by imagining himself in a terrifying sitation (a phantasy of fear).

(8) *Effect of light.* The appearance of light stops e waves in 0.1 to 0.2 second. Seven tenths seconds r more may elapse before they again start after the ght disappears. This influence of light is certainly ot a direct effect but rather a secondary one, for the llowing reasons. If the eyes are kept open coninuously and the subject is lying quietly in a lighted oom, a few trains will usually appear after a time. On the other hand, if the subject is lying in a completely dark room and a faint light has been flashed n and off several times at regular intervals, then if he s told that the light will be flashed on, the trains will top, even though the light is not flashed on. This effect is best seen (with the subject in a dark room) by imultaneously turning on a light and sounding a tone t regular intervals. After a time the sounding of the one alone will stop the trains, although before this "conditioning" the tone alone has no such effect. In he case of a hypnotized subject the converse was lso true, *i.e.*, the trains would start up at once when e was told he could not see the light, even though it continued to shine directly into his eyes.

(9) *Flicker.* We find, as does Adrian, that flickerng lights give rise to potentials in some persons that exactly follow the flicker frequency over a limited range. Occasionally the brain response will be double he flicker frequency. In one subject who showed unusually regular trains no flicker frequency could be induced.

(10) *Sleep.* As a subject is going to sleep the trains appear regularly, but they cease after a time during deep sleep. And yet they will immediately appear if the subject is disturbed. Noises, etc., that the subject is accustomed to hear during sleep, such as the blowing of an automobile horn, do not necessarily have any effect, but anything that indicates that another person is near almost always produces a marked effect with the immediate appearance of the trains. Thus, a faint cough, a whisper, faint footstep, rustling a piece of paper, have all produced trains when loud noises and bright lights have failed. We are inclined to believe that this starting of trains by sound is not a direct result of the sound stimulus but is connected with a change in the general level of brain activity.

ALFRED L. LOOMIS
E. NEWTON HARVEY
GARRET HOBART

LOOMIS LABORATORY,
TUXEDO PARK, N. Y.

LEAF XANTHOPHYLLS

As a result of the improvement of methods for the isolation of carotenoids, it has been found that leaves contain not less than twelve, and probably more, xanthophylls. Many of these are very soluble in aqueous alcohol and are not recovered from the dilute alcoholic solutions employed in the partition and crystallization methods of Stokes and of Willstaetter. Several of the xanthophylls are adsorbed with the chlorophylls upon Tswett columns and, under the conditions previously employed, are not observable in the presence of the green pigments. Others occur in such small amounts that they can be detected only by the use of Tswett columns composed of very active adsorbents.

In order to demonstrate the presence of such a great number of xanthophylls in leaves, it has been necessary to develop methods for the isolation of all the xanthophylls free from other leaf constituents. This mixture of xanthophylls is then separated by adsorption upon Tswett columns. The successful application of the latter method has been due to the selection of highly active adsorbents which do not decompose the plant pigments and to the availability of a number of solvents which may be used to vary the quantity of pigment held by the adsorbent.

When leaf xanthophyll, prepared by the improved method, is adsorbed upon Tswett columns, three or four pigments pass rapidly through the column. These pigments resemble Cryptoxanthin with respect to solubility and to partition between immiscible solvents. They are followed on the column by lutein, which comprises somewhat more than half the recoverable xanthophyll. The lutein is followed by a pigment not previously described, for which the name "isolutein" is proposed. The isolutein is optically inactive, its absorption maxima are twenty Ångström units toward the violet from those of lutein and, in contrast to lutein and zeaxanthin, its solutions in ether exhibit a deep blue color when treated with concentrated hydrochloric acid. Zeaxanthin, which is present in small

amounts, is found above the isolutein on the adsorption column. The former has been found in all the leaves examined (those of barley, carrots, filaree, miner's lettuce, sunflower, squash and spinach) and is identical with zeaxanthin isolated from the calyx of *Physalis alkekengi* with respect to melting point, optical activity, quantitative absorption spectrum of its solutions, absorption maxima in different solvents, adsorption upon Tswett columns and elementary composition. The zeaxanthin is followed upon the column by a pigment, the absorption curves of which are similar to those of flavoxanthin (absorption maxima 4510 and 4220 Ångström units in ethanol). The pigment is optically active ($[\alpha]^{18}_{6678} = +75°$ in chloroform). Another similar pigment, which exhibits a like absorption curve (absorption maxima 4510 and 4220 Ångström units in ethanol) but opposite optical rotation ($[\alpha]^{18}_{6678} = -56°$ in chloroform), is adsorbed next on the column. It is followed by considerable quantities of a xanthophyll, the absorption curves of which are intermediate in shape between those of lutein and those of the flavoxanthin-like pigments (absorption maxima 4667 and 4374 Ångström units in ethanol). Upon partition between 60 per cent. methanol and petroleum ether, this pigment was distributed almost entirely in the methanol. It is followed on the column by several xanthophylls, which occur in small quantities and which remain adsorbed near the top of the column, even after the latter has been washed repeatedly with fresh solvent.

It now seems established that several of the adsorbed pigments observed by Tswett are mixtures of two or more xanthophylls. Many of these are not identical with previously described substances of this nature and, even though many of them occur in small quantities, together they constitute a considerable proportion of leaf xanthophyll.

The physical and chemical properties of the leaf xanthophylls are being redetermined. When this is accomplished, a complete description of the compounds isolated and of the methods used in their preparation will be published elsewhere.

The observations recorded in this note are of particular significance in relation to methods for the quantitative estimation of leaf xanthophyll. The variations in the composition of leaf xanthophyll, which result from different methods of preparation, and the great differences in the absorption spectra of the different constituents preclude the use of most xanthophyll preparations as standards or reference substances for the determination of xanthophyll concentration by comparative spectral absorption methods. The heterogeneity of leaf xanthophyll and the variations in properties of the constituents account, no doubt, for the divergent values which have been reported for the xanthophyll content of leaves.

HAROLD H. STRAIN
CARNEGIE INSTITUTION OF WASHINGTON
STANFORD UNIVERSITY

THE AVERAGE PORE SIZE OF DIAPHRAGMS[1]

IN connection with some investigations of the relationship between surface charge density of adsorbed ions and ionic antagonism,[2] it became necessary to evaluate the mean pore radius of cellulose and powdered quartz diaphragms.

The expression for electrical conductivity,

$$C = \frac{l}{\pi r^2 n},$$

(where C is the cell constant and n the number of capillaries of mean length, l, and mean radius, r) was substituted into Poiseuille's law,

$$V = \frac{\pi P r^4 n}{8 \eta l}.$$

Here V represents the rate of flow in cc per sec. under a pressure, P, in dynes per cm.[2] The resultant equation,

$$r = \sqrt{\frac{8 \eta C V}{P}},$$

can be used to estimate r, assuming a capillary of circular cross-section (as, in general, with most of such methods) and a membrane of non-conducting material. A relationship of this degree of simplicity does not appear to have been previously described.

Diaphragms were made by packing the desired material into a streaming potential cell of the type used by Martin and Gortner.[3] The origin of the quartz and cellulose used has been described before.[4] The cell constant was measured with the diaphragm filled with N/10 KCl to eliminate the effect of surface conductance. Since the pierced gold electrodes form the ends of the cell, electrical conductance and liquid flow data can be directly compared. Any narrowing of the effective pore radius by imbibition of water should be accounted for by this method.

The rate of flow was found to be linear with pressure and independent of time; no blocking effects could be noted. The radius of the quartz diaphragms investigated ranged from 1.4 to 30 μ, depending upon the degree of grinding. On the other hand, cellulose membranes were more uniform in behavior, with a

[1] Paper No. 1355 Journal Series, Minnesota Agricultural Experiment Station.

[2] L. S. Moyer and H. B. Bull, *Jour. Gen. Physiol.*, 19: 239, 1935.

[3] W. M. Martin and R. A. Gortner, *Jour. of Phys. Chem.*, 34: 1504, 1930.

[4] H. B. Bull and R. A. Gortner, *Jour. of Phys. Chem.*, 35: 309, 1931; 36: 111, 1932.

radius of 0.88–0.98 μ. The mean radius of cellulose diaphragms was found to be independent of the electrolyte concentration, whereas the values for finely ground quartz rose with increasing salt concentration to a constant value at 4×10^{-4} N NaCl. These data illustrate the use of this simple method, which should prove of value in other investigations of this character. A more detailed discussion of these results has been presented in a later paper.[5]

HENRY B. BULL
LAURENCE S. MOYER,
National Research Fellow in the Biological Sciences
UNIVERSITY OF MINNESOTA

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE APPARATUS TO FACILITATE THE PREPARATION OF BACTERIAL VACCINES[1]

ONE of the main problems in preparing bacterial vaccines on a large scale is to prevent contaminations during the process of preparation. Since a large number of bottles are used in preparing vaccines and each bottle must be opened several times, it is frequently difficult to avoid contamination. The usual procedure in collecting the bacterial growth from the inoculated bottles is to add saline to each bottle and collect the bacterial suspension into a sterile bottle by means of volumetric pipettes. This is of necessity a slow procedure and the vaccine is exposed to contaminations repeatedly; because the collecting bottle must be opened a number of times to discharge the contents of the pipette.

A simple apparatus has been devised which eliminates the use of pipettes and reduces the risk of contaminations to a minimum. The apparatus consists of a special burette for adding saline to the bottles containing the bacterial growth, as illustrated in Fig. 1, and a tube for collecting the vaccine, as shown in Fig. 2. The burette is connected serially by means of rubber tubing to a bottle of sterile saline, an empty sterile bottle and a bottle of 5 per cent. phenol. These bottles have two-hole rubber stoppers, glass tubes and rubber-tube connections (see illustrations, Fig. 1). The burette, collecting tube and the connections are sterilized separately and are assembled aseptically before use. All parts of the apparatus are protected against contamination. The top of the burette is plugged with cotton, which is wrapped in cheese-cloth and after plugging is covered with a paper cap. The delivery point of the burette is protected by a glass bell, which is also covered with a paper cap. The open end of the rubber tube on its side arm is placed in a glass tube, which is plugged with cheese-cloth. Similarly, all open parts of the connections for the bottles (Fig. 1) and the collecting tube (Fig. 2) are protected by glass tubes. They are then wrapped in paper separately and are sterilized in the autoclave for one hour at 15 pounds pressure. After the apparatus is assembled, as shown in Figure 1, the bottle containing the phenol is connected with a pressure pump. The metal clamps "h" are opened and air is forced through the phenol which sterilizes it before it reaches the saline. The intermediate empty bottle serves as a safety valve in case too much pressure should force the carbolic into the adjoining bottle. The burette is filled by opening cock "a" on the side-arm, which is closed when the saline reaches the zero mark. The desired amount of saline is then added to the bottles containing the bacterial growth by opening and closing cock "b" on the delivery tube. Both the mouth of the bottle and the delivery point of the burette are protected by the glass bell. During the entire operation all parts of the apparatus are completely protected against contamination.

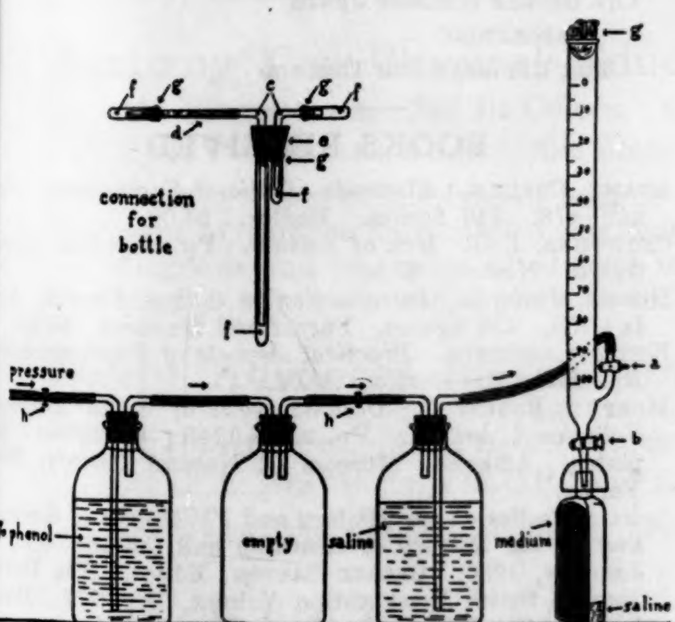

FIG. 1. a—cock or side arm of burette; b—cock or delivering tube of burette; c—glass tubes of connection; d—rubber tube; e—two-hole rubber stopper; f—glass tubes; g—plugs; h—metal clamp.

When the saline is added to all the bottles the burette is replaced by a sterile collecting tube, as illustrated in Fig. 2. This consists of a glass tube that has a constricted and slightly bent point. This tube is protected from contamination by an outer glass tube whose diameter is the same size as the neck of the bottle containing the bacterial suspension. The collecting tube is held in place by a perforated rubber cap and it slides back and forth in the outer tube. The outer tube serves a two-fold purpose—it protects the collect-

[1] From the Bureau of Laboratories, New York City Department of Health; Director, W. H. Park, M.D.

[5] H. B. Bull and L. S. Moyer, *Jour. Phys. Chem.*, 40: 9, 1936.

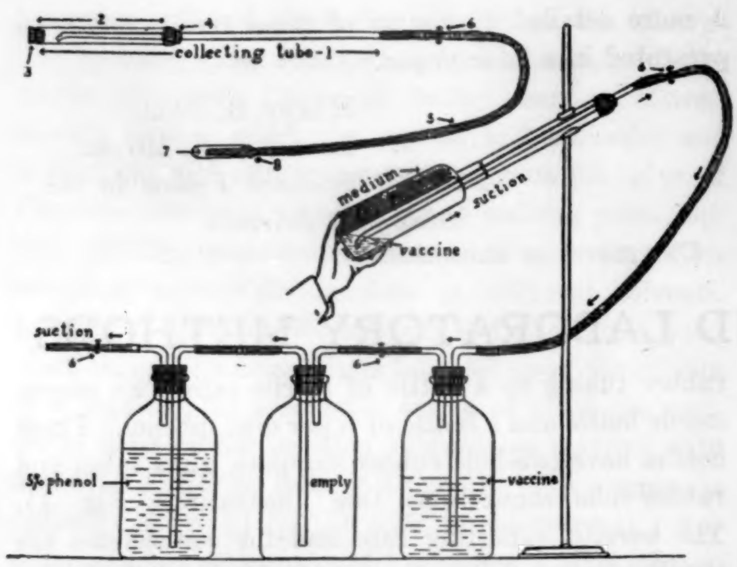

FIG. 2. Collective tube. (1)—glass tube; (2)—outer glass tube; (3)—solid rubber stopper; (4)—perforated rubber cap; (5)—rubber tube; (6)—metal clamp; (7)—glass tube; (8)—cheese-cloth plug.

ing pipette from contamination as well as the mouth of the bottle during the process of collecting the vaccine. The collecting tube is connected serially by means of a rubber tube with two sterile bottles and a bottle of 5 per cent. phenol (see Fig. 2). The bottle of phenol is connected with a suction pump, and the bacterial suspension is collected by means of suction. A clamp (6) at the top of the collecting tube stops the suction as soon as the growth of the individual bottle is delivered into the vaccine-bottle and the collecting tube is withdrawn from the bottle into the outer glass tube. Thus the tip of the tube is protected and no air is allowed to be drawn into the vaccine bottle.

When the growth from all the bottles is collected, the suction pump is stopped, and air is allowed to flow through the phenol. This sterilizes the air before it enters the bottle of vaccine and fills the vacuum there. The collecting pipette is then disconnected, and the two-hole stopper in the vaccine bottle is replaced by a sterile solid rubber stopper.

This apparatus has been used successfully in our laboratory for the past year. It facilitates the preparation of bacterial vaccines in that it saves time and labor and reduces contaminations to a minimum.

I wish to express my appreciation to Miss Mildred Melman for making the drawings from the model.

LUCY MISHULOW

THE PRODUCTION OF HIGH VELOCITY IONS FOR THE DISINTEGRATION OF ATOMIC NUCLEI

LAWRENCE has been able to give in the cyclotron a multiple acceleration to positive ions in a uniform magnetic field and has obtained very high velocities of the particles. Thus energies of the order of seven million electron volts have been attained, and an increase to ten million should be accomplished soon. In the cyclotron the ion is accelerated twice by the high frequency electrical field during each (approximately) circular orbit.

In experiments on a small apparatus it is proposed to endeavor to apply the use of a three-phase oscillator system to give either three or six accelerations per revolution of the positive ion in its orbit. If successful this should make it possible to attain much higher equivalent voltages. The principal difficulty involved is that of getting a satisfactory high-frequency, high-voltage, three-phase oscillator system.

Consideration of the simplest and least effective application of a three-phase potential, such as that in which it is connected to a trisector electrode cyclotron, for example, as compared with a duant cyclotron, leads to the following results: An ion is accelerated three times instead of two times per circuit. The ion density is reduced 50 per cent. The capacity of the electrode is reduced 33 per cent. The proper sequence of accelerating voltages in a forward direction occurs every 120 electrical degrees. In the reverse direction the proper sequence occurs only half as often, *i.e.*, every 240 electrical degrees. Resonance is preferred in the forward direction. In the duant type the accelerating potential in both the forward and reverse directions occurs 180° apart. The magnetic field frequency of the oscillating potential and the root mean square high frequency potential are the same in both cases. The use of six electrodes instead of three would be much more efficient.

ROBERT J. MOON
WILLIAM D. HARKINS

THE GEORGE HERBERT JONES LABORATORY
THE UNIVERSITY OF CHICAGO

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